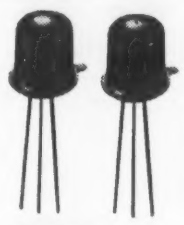
SIGNAL

December 1961

Season's Greetings from the Armed Forces Communications and Electronics Association



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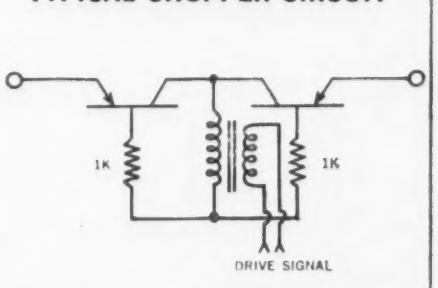

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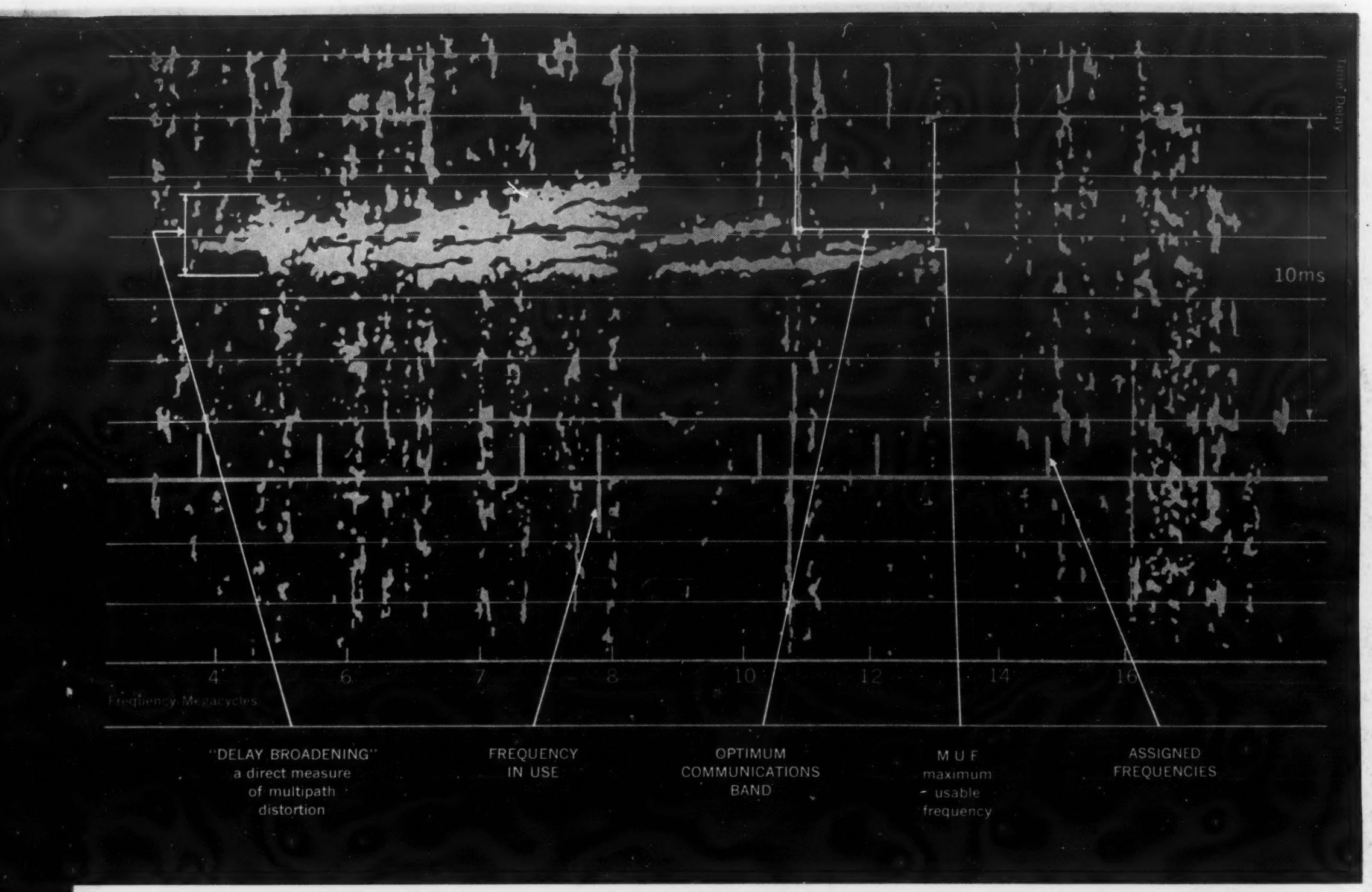

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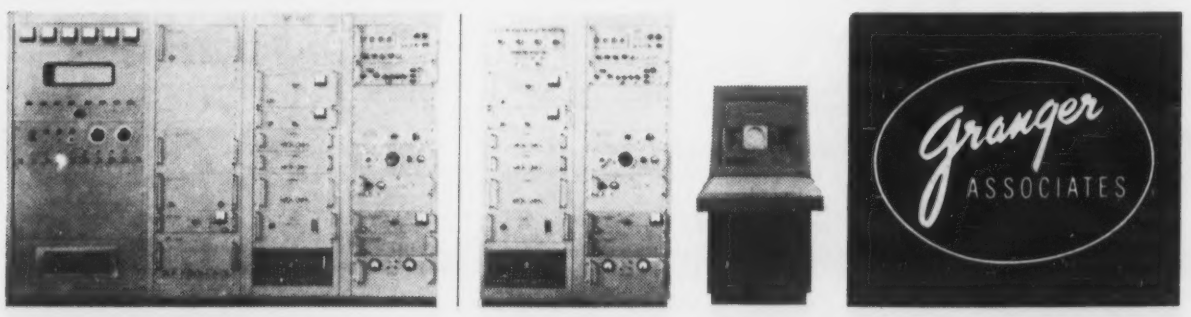

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BPA

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On behalf of the National Officers and Directors of the Armed Forces Communications and Electronics Association, SIGNAL *magazine extends Season's Greetings to our individual members, corporate members and advertisers whose generous support has contributed to a year of Association progress.*

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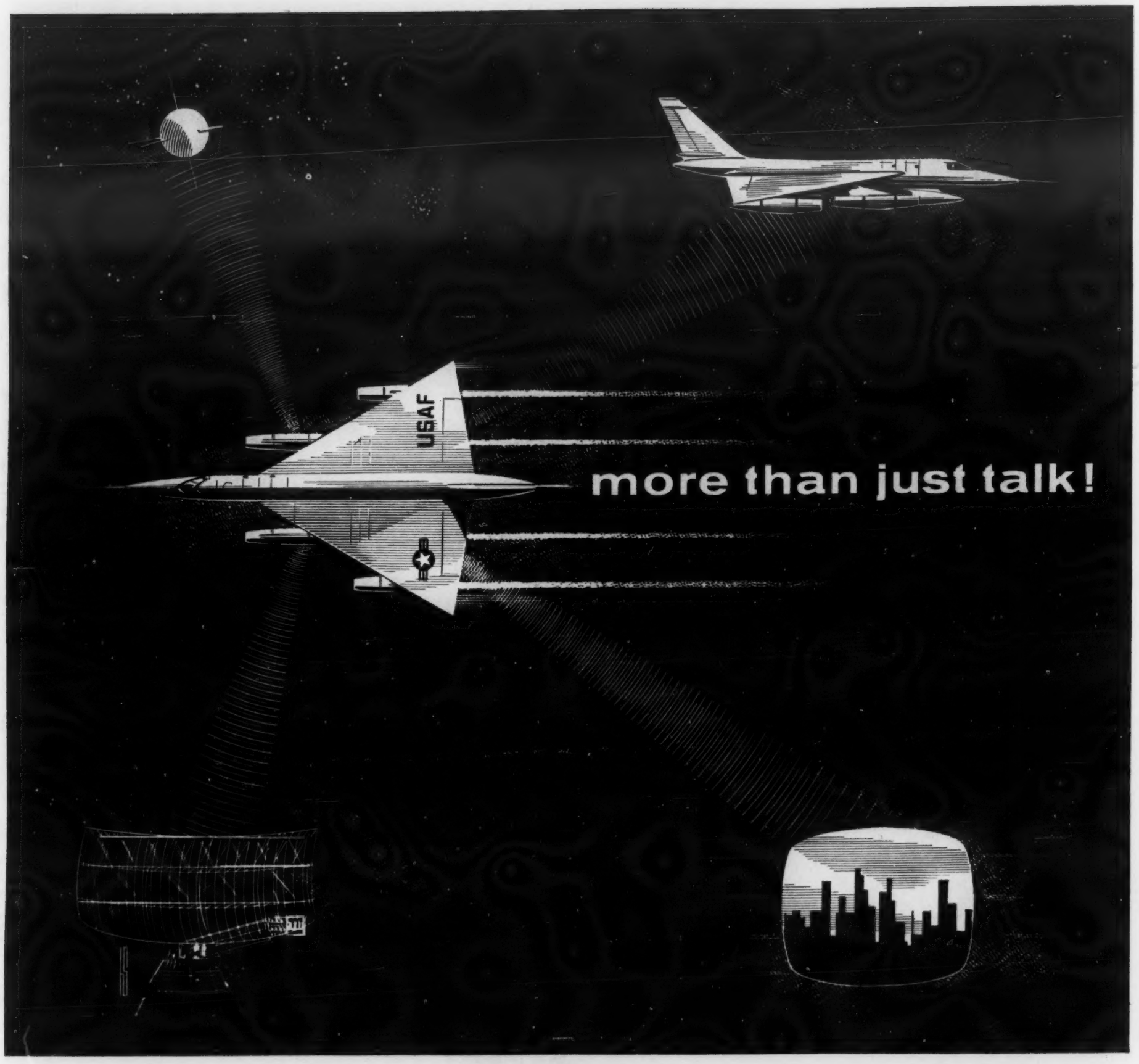

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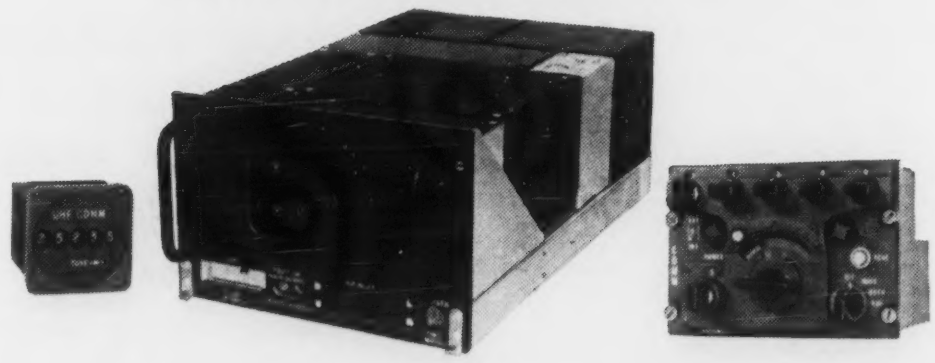

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by
Dr. Leonard S. Sheingold
Chief Scientist
USAF

ROLE OF THE SCIENTIST IN GOVERNMENT AND INDUSTRIAL OPERATIONS

I WOULD LIKE to discuss the shortage of qualified scientists and engineers and some possible long-range solutions to the problem. Approaching a subject of this type usually requires a definition of various categories of scientists and engineers.

A few years ago, Dr. Lee A. DuBridge suggested that there are at least five distinctly different kinds of engineers. There is the research engineer who is usually indistinguishable from the applied physicist. There is the development engineer who is more often an inventor than an analyst; there is the design engineer who performs many of the classical functions of the engineer in industry and who actually determines the character of the product the user will get; there is the production engineer who is concerned with tooling, production processes, schedules, and quality control, and finally there is the applications or sales engineer who makes the product acceptable and useful to the first consumer. These men for all their common background in engineering have very different jobs.

The diversity of their approaches is illustrated by an experience of Professor H. Guyford Stever of Massachusetts Institute of Technology. The sons of each of these five types of engineers, all of whom were engineering students at M.I.T., were given a *ball of twine*, an *aneroid barometer*, a *stopwatch*, a *yardstick*, and an *engineer's handbook* and told to measure the height of the steeple on the town church, a suitable reward being stipulated in exchange for a reasonably correct answer.

The research engineer's son climbed to the top of the steeple—dropped the barometer, timed the fall with the stopwatch and calculated the distance (including a small correction for drag). The development engineer's son climbed to the top of the steeple, tied the string to the barometer, let the barometer down gently until it was very close to the ground, swung it as a pendulum, timed it, and calculated the length. The design engineer's son climbed the steeple, read the barometer, came down, read the barometer again, and looked up the height in the tables. The production engineer's son climbed the steeple, tied the string to the barometer, allowed it to descend slowly to the ground, tied a knot in the string, came down, and measured the length with the yardstick. The sales engineer's son went into the church, found the sexton and said, "Look, I'll give you this barometer if you'll tell me the height of the steeple."

Since the Air Force has a vital interest in all aspects of technology, I will consider the impact that a broad spectrum of technology has on future Air Force planning. This spectrum includes Basic Research, a search for new concepts and principles to increase our fundamental knowledge; Applied Research, investigation of the application of new principles to practical ends, and Engineering, the art and science of making products or "hardware."

This year the Air Force will spend 50.5 million dollars for the support of basic research. About 65 per cent of the support for fundamental work will go to universities in this country and abroad. In addition to this investment in basic research the Air Force also will spend 244 million dollars in the applied research area. This considerable investment will be

Dr. Sheingold is pictured above as he addressed the Washington D. C. chapter members at their October AFCEA meeting.

supplemented by a much larger amount to be spent in the development, engineering, and testing of new weapon systems for our national security. *The reason that the Air Force supports such a wide range of technology is to diminish the time interval between discovery and application so that we may compete with the Sino-Soviet Bloc.*

The marked reduction in time from basic research to application has had important effects on the relationships among the engineer, the scientist, the military, and more recently the educator. Until World War II there was sufficient time for the engineer to absorb results of new basic knowledge without daily contact with basic research progress. Since World War II there has been a profound change in this situation. You well know that the compression of time coupled with increasing complexity of weapon systems has resulted in tremendous demands for scientists who are also application oriented and for engineers who can readily adapt to new technology. Technical achievements such as the jet bomber, radar, the thermonuclear bomb, electronic computers, and earth satellites have witnessed the rapid injection of new science into technology and the close working relationship between scientists and engineers. It is because of the possible immediate military importance of almost any advance in science that the Air Force maintains the best possible communications with universities and the scientific community.

Unfortunately, the supply of our scientists and engineers remains short. This past year the Russians graduated more than twice as many engineers as we did. The number of competitors for the nation's valuable scientific and engineering talent is continually increasing. Today, there are five classes of competitors. They are Department of Defense (Air Force, Navy, Army), other Government agencies (NASA, AEC, etc.), industry, universities, and non-profit making organizations (Aerospace, Lincoln, Rand, Mitre, etc.).

Only recently General Curtis LeMay, Air Force Chief of Staff, summed up the scientific and engineering manpower shortage problem most succinctly. He said, "Obviously we need high caliber people to develop, maintain, and operate the complicated weapon systems we have now and the ones that are coming along. We need a lot of technical and scientific people. But the country only produces a certain number and everyone competes for their services."

If General LeMay were to ask for recommendations leading to a long range solution which would satisfy our requirements for more scientists and engineers, I would propose the effective utilization of our experienced scientific and engineering personnel; improved quality of instruction at the high school, the college, and especially the grade school level, and the identification, education, and training of individuals who have the ability to become competent scientists and engineers.

If we examine the dynamic growth of technology during the past ten years in light of these three proposals, we discover that there are danger symptoms which bear careful watching. These are characterized by "the migratory worker," "the triple-threat professor" and the "lost-half."

The Migratory Worker

The growth of the defense industry in this country has resulted in a situation where a large number of scientists and engineers move constantly from one job to another and from one city to another. These migratory workers take on new jobs at frequent intervals and a good number of them have probably never had the self satisfaction of having completed a single project. These individual movements generally fall in the category of "how to succeed in business without even trying."

There are other migrations which occur whenever large scale government contracts are awarded or cancelled. Many of these mass movements, although unavoidable, result in an inefficient utilization of our national technical resources.

The rapid growth of new organizations such as the National Aeronautics and Space Administration, Aerospace Corporation, and The Mitre Corporation results in the shifting of research and development personnel from other sources namely government, industry, and universities. It is intuitively obvious that if the numbers of migratory workers continue to increase, our technical productivity will be adversely affected and the effective manpower shortage will be further intensified.

Within the Air Force itself there has been much discussion and concern about the proper utilization of its 10,000 in-house civilian scientists and engineers. Recently the Air Force Council of Scientists was established by General LeMay to provide a forum for the Air Force key technical personnel. The Council, headed by myself as Chief Scientist, held its first meeting last September. Serving as members of the Council are the key technical civilians in the Air Force representing Headquarters and various Command functions. In addition to the Council there is an in-house Air Force consultant group forming the nucleus of a pool of military and civilian scientific consultants available for technical advice to all elements of the Air Force. In addition to its advisory and communicating role the Council will help identify problem areas and sort out matters needing special scientific competence. The Air Force Council of Scientists represents only one action of a series of actions that have been taken recently to improve the utilization of existing resources within the Air Force. Such improved manpower efficiency effectively decreases the national demand for increased numbers of scientists and engineers.

The Triple Threat Professor

The second long range proposal involved quality of instruction.

The university professor today who is well established as an authority in his field spends most of his time on individual research, as a consultant to industry, and as a member of many government committees. The triple threat character of the science and engineering university professor dilutes his capability to satisfy the tremendous demands for education in training scientists and engineers. There have been many questions raised recently as to whether or not the quality of scientific and engineering instruction in universities can be maintained. According to the U. S. Office of Education the total college enrollments will nearly double during the 1960's but faculties including scientists and engineers will rise only about 50 per cent.

If in some way our more competent professors could have time to initiate a back-to-teaching movement the quality of instruction would improve significantly.

Furthermore, statistics show that colleges appear to be losing out in the competition for trained personnel. Increasingly, colleges are filling vacancies with men who do not have doctorates. From 1953 to 1960 the proportion of newly appointed college teachers in the physical sciences who had doctorates declined by 6%. During the same period the number of Ph.D.'s rose about 20%. More and more of the new crop of science Ph.D.'s go to industry either directly upon graduation or after a few years as a research professor. This trend deserves careful watching in the future.

(*Continued on page* 26, *col.* 2)

60 YEARS and BEYOND

by
GENE K. BEARE
President
Sylvania Electric Products Incorporated

WHILE WE POISE on the threshold of aerospace, we cannot help but stand in awe at the terrific range of possibilities inherent in the exploration of the Solar system and of what will be written in future history books.

In reflecting upon the staggering progress recorded during Sylvania's lifetime, it is not completely realistic to consider the entire 60-year span as a single frame of reference. Although a great number of highly significant research advances came prior to and during World War II, the true technological explosion—in a developmental sense—has occurred during the past 15 years.

Solid-state physics, data processing, thermonuclear research, micro-electronics and nuclear physics represent just a handful of the strange new areas of activity that have become commonplace since the second industrial—or scientific—revolution was inaugurated in 1945. Breakthroughs occurred virtually across the board in electronics, metallurgy, petrochemistry, plastics, and molecular physics. Rare metals and new processes were put to work, particularly in the space and defense programs.

The next chapter of the space story—to be written over the next 15 years—will be the most exciting of all. After Project Mercury will undoubtedly come lunar probes, a landing on and exploration of the moon, and eventually exploration of Venus and Mars.

Closer to home, we will witness development of truly large computers, the possibilities of control for which are almost unlimited. Inexpensive electric heating for our homes may come from a hydrogen-helium fusion reactor. In the area of basic research, we will see some real breakthroughs in nuclear physics; relativity; metallurgy—particularly those areas associated with pure crystals; in the understanding of what liquids are all about, and in direct synthesis of organic compounds.

Our pressing defense requirements growing out of the threat posed by the Soviet Union have, in a sense, partially forced this scientific revolution in America. These requirements have compelled us to channel our energies and our ingenuity into basic research, as well as mass production techniques.

We have come far, but the task ahead involves not only the best efforts of the Armed Services, but also industry, education and government. It is truly a national effort, a team effort.

Keeping this "team" concept in mind for a moment, I would like to refer to highly appropriate remarks made last spring by the Honorable Elvis J. Stahr, Jr., Secretary of the Army:

> "It is imperative that industry contribute its best thought to our defense planning, and play an active role in every phase of materiel development. As a full partner in defense, it should apply itself with foresight, initiative and imagination to the evolution of new ideas which could contribute to the effectiveness of our armed forces. It should, if possible, go forward even further and faster than the services themselves in anticipating demand by applying its own resources, on its own volition, to the exploration of every field of science and technology in search of better methods and means of carrying out the nation's defense tasks."

It is to the accomplishment of these basic goals that the division headquarters and Applied Research Laboratory facilities of Sylvania Electronic Systems are dedicated.

The division has over-all responsibility for systems management of General Telephone & Electronics, coordinating the broad defense systems capabilities of the various GT&E subsidiaries. This responsibility is centralized within the division's Systems Engineering and Management Operation (SEMO), which represents GT&E in all activities relating to large military systems contracts —obtaining these contracts, doing the required system engineering, and managing the contract program.

SEMO encompasses four specific areas of capability interest—communications systems, command and control systems, space systems, and defensive weapons systems.

A typical SEMO program—illustrating a communications capability for weapons or support systems—is installation of inter-site communications systems at Atlas missile squadron bases. In this program, SEMO heads a team including Sylvania, Lenkurt Electric Company, another subsidiary of GT&E; General Cable Corporation, and Ets-Hokin & Galvan, Incorporated.

The data processing portion of the Ballistic Missile Early Warning System is another typical SEMO program, and one which exemplifies a capability in command and control of weapons and support systems. Closely related

to this broad systems management group is the Applied Research Laboratory. These groups are symbols of our management's hard-headed pledge to the future—a future that will be shaped largely by the scientists and engineers.

Let us consider briefly the nature of the Applied Research Laboratory and the programs that make it a dynamic, forward-looking operation.

It is engaged in basic and applied research in the fields of communications, information processing, radio and space physics, space techniques, mathematics, engineering, operations research, and advanced systems concepts.

As a central research facility, it has conducted studies within the space communications field for our Amherst Laboratories in New York State, and provided them with consulting assistance on buried antenna characteristics for the command communications sub-system of the Minuteman missile's radio launch control system.

The Applied Research Laboratory also made contributions to the development by our Waltham Laboratories of the ground antenna system for the Advent satellite communications program—providing a new control system for steering the huge antenna five times more accurately than previous systems.

Limiting ourselves for a moment to the area of communications programs within the Applied Research Laboratory, it is worth emphasizing that the Laboratory is conducting broad research into improvements in the communications art. This research involves communications from man-to-man, between man and his environment, and—in the most recent and astounding area of accomplishment—between man and machine.

The research extends over a wide variety of scientific disciplines, and requires studying the communications media and the methods for utilizing these media for transmitting or transporting information from one point to another—whether these points are on earth or out in space. Consequently, the laboratory personnel find themselves investigating the earth itself, its atmosphere, space, and other extra-terrestrial media.

Since both time and available frequency spectrum are limited in many applications, the investigation of methods of transmitting information efficiently and in some cases with privacy is also a prime area of study. Moreover, the search for new spectral regions useful for communications purposes, methods of utilizing these regions, and new methods for generating and detecting energy also are important.

Finally, the linking of man to the communication system requires an understanding of man's own sensory perception and thought apparatus. This is true whether the system is one which transmits information from one man to another, thereby requiring the linking of man into both ends of the system; whether the system links man to his environment, as with our modern detection and surveillance systems; or whether it links man to a machine —where here again the man may be a generator or receptor.

This investigation of man's own sensory perception and thought apparatus is one that is presently stimulating much interest and expectation throughout the field of science. One of the most exciting developments in this area has been the recent formulation of a mathematical theory of color vision by Doctor Huseyin Yilmaz of the Applied Research Laboratory.

As all of us know, color as seen by the human eye does not depend upon light conditions for a wide range of natural illuminations. For instance, the walls of a building painted blue appear blue from that hour of the morning when the first rays of the sun begin to peek over the horizon right through the day until darkness descends. That is, they appear blue to those of us who are not color blind.

Moreover, the buildings appear blue and the same shade of blue whether it is cloudy or sunny. They even appear blue at night under natural moonlight—or if we illuminate them with a floodlight. This is true despite the fact that—throughout all of these conditions of illumination—the physical attributes of the light reflected by these walls bear little similarity either in spectrum or in intensity.

Previously, physicists have not been able to understand why or how the human eye accomplishes this perception of a "true" color—independent of what is actually transmitted. Psychologists have attributed it to nominal mental processes such as adaptation, optical illusion, and color contrast.

Doctor Yilmaz has succeeded in providing a set of mathematical formulas which describe the processes that occur in the ideal human perception of color. In practice, experiments have verified that most humans operate in a manner which closely approximates the Yilmaz theory. Consequently, we have here the first of what we hope will be a long series of mathematical descriptions of human sensing processes.

Why is this a major accomplishment? What are its implications? We foresee at least two immediate implications of such mathematical theories. First of all, having a model of a human perceptive process allows us to match a machine's output to man's capabilities and natural preferences—such as in photography, television, or in a data display system using color ideally suited to man's perception. Secondly, since we are all well aware that human data processing is highly efficient, our new knowledge will allow us to simulate or utilize the best aspects of human processing in machine design for the benefit of mankind.

Let us consider satellite weather detection as an example. The achievements of the meteorological satellites of the National Aeronautics and Space Administration (Tiros I, Tiros II and Tiros III) in the early detection of hurricanes such as this year's "Esther" have shown that such satellites can be very beneficial in predicting weather both from the military and the civilian viewpoints.

Yet, such satellites are completely color blind. That is, they sense only black-and-white. If such satellites could utilize chromatic or color information, they would be much more sensitive to meteorological variations. Another dimension would be added.

The application of color detection has been hampered, heretofore, by the fact that such satellites must operate in orbit under both daylight and night-time conditions. Thus, in order to detect color, a capability almost human in nature—as I described above—is required. With the mathematical theory of color perception now available to us, the construction of a sensory device which would allow us to detect color within the Tiros field of view over most of its circuit around the world appears within the realm of practicality.

Since the exciting new mathematical concept of color vision represents the initial results of just one of many research projects moving ahead continuously within these facilities, one need not wonder why we attach a great deal of significance to their dedication—or why we consider them symbolic of accelerated growth by General Telephone & Electronics within the broad area of defense electronics.

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W. J. Baird, General Manager & Editor

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Part II

Synopsis Part I: In the November SIGNAL, Mr. Haley commented on the value of space telecommunications and explained briefly some technical considerations involved in reaching international agreements in this area.

Space Communications

THE PRINCIPAL subject matter to be discussed in Part II is the Communist attitude toward international cooperation in space telecommunications. Although the allocation of radio frequencies is in an almost uniquely high degree a purely technical and scientific matter and although it lends itself to international regulation perhaps better than any other field of human activity, the whole field of space telecommunications is an integral part of the general subject of space law. And as part of the general field of space law, the allocation of radio frequencies is subject to many of the political considerations which have prevented the rapid solution of other legal problems of space exploration.

The Soviet Union is controlled by the Communist Party and the Party gives political interpretation to activities which we in the West, perhaps erroneously so, regard as non-political. Thus the use to be made of radio spectrum is within the primary jurisdiction of the Communist Party. And although the Soviets often assiduously observe the mandates of international law and speak of inalienable rights almost as one would of natural law, when the requirements of political expediency dictate otherwise, the Soviets adopt a positivistic approach to international law and may contend that for certain purposes international law does not exist.

The Soviet manipulation of the legal concept of sovereignty is an excellent case in point. Thus when allocation agreements are not satisfactory to the Soviets, they invoke the principle of the sovereign equality of nations, which allegedly requires that international agreements be based on parity of representation reinforced with a right of veto. In referring to the first allocations of radio spectrum for space communications, adopted at the 1959 International Telecommunication Convention, Dr. Jan Busak stated that this 1959 agreement was not final, among other reasons, because it did not represent the interests of all the parties.[4]

Similarly the application of the 1959 agreement to space vehicles is limited by the contention that in outer space international law does not exist. The Communists state that the 1959 agreement extends only to violations of sovereignty, and since outer space is defined as being in a "legal vacuum," above the reach of international law, and hence above the operation of the legal principle of sovereignty, the Soviet transmitters broadcasting in violation of frequency allocation agreements are not within the jurisdiction of the agreement. Furthermore the Soviets have been careful to maintain a non-committal policy on the height at which this "legal vacuum" begins.

This argument of the Communists is put forth, but characteristically in non-committal terms, in the same article by Dr. Busak referred to above. In this article Dr. Busak points out that the preamble of the International Telecommunication Convention (Buenos Aires, 1952) recognizes "the sovereign right of each country to regulate its own telecommunications." [5] Dr. Busak concludes that radio wave propagation is subject to the sovereignty of individual nations and that therefore the International Telecommuncation Convention would violate state sovereignty by attempting to prohibit broadcasting on specific frequencies.

Dr. Busak contends that there is no international authority capable of regulating the propagation of radio waves through either air space or outer space. The maximum that an agreement reached at the International Telecommunication Convention can achieve, even after ratification by the individual states, is the regulation of violations of the sovereignty of other states. As long as there is no harm done to another state, the signatory nations to an International Telecommunication agreement, may broadcast on whatever frequency they choose. Dr. Busak adds that, because sovereign interests do not exist in outer space, the only effect of an ITU agreement on space communications would be to prevent broadcasts from spaceships and satellites which interfere with the sovereign rights of nations within their own territory on earth. This would seem to give the Soviet Union the right to broadcast entirely without restriction as long as no one can bring proof of resulting harm.

The legal means by which the Soviets avoid committing themselves to international regulation of space communications, however, is only the result of policies already adopted. The cause of these policies is a separate question.

The Soviets are adamantly opposed to conducting research by joint efforts, for example by a United Nations' body. Such proposals, however, are opposed even by the United States, on the basis that governmental control must be maintained over equipment and experiments as expensive as those required for research in outer space. Former Presidential Science Advisor George B. Kistiakowsky pointed out the difficulty of such cooperation by his recognition of the fact that, "the complex governmental machinery of the United Nations would inevitably have to face political issues unrelated to scientific cooperation." [6] Dr. Kistiakowsky recognized that international scientific planning and cooperation is clearly desirable, but possible for the time being only at the scientist level and at the initiative of non-governmental organizations.

The policies behind Soviet reticence to cooperate even in non-governmental bodies such as the International Telecommunication Union, are less obvious than those behind opposition to official cooperation. The fact that at the 1959 Conference 10 of the 13 bands adopted for space-communications were the result of American rather than Soviet proposals, and the fact that the Soviets did not advocate allotting any bands exclusively to space-communications use, is undoubtedly caused in some measure by the Soviet desire to conduct further research on the optimum frequencies for space telecommunications in order to prevent the establishment of international law contrary to the best interests of science.

In addition to this reason, however, the Soviets are probably trying to avoid commitment to any position which may prejudice their strategic position either now or in the future. The commitment to specific frequencies would facilitate American monitoring of Soviet activities

and Cooperation With Iron Curtain Countries

by ANDREW G. HALEY, General Counsel, American Rocket Society

in space and the violation of established frequencies would act as a warning signal to American military planners. As long as the Soviets are ahead in space exploration, cooperation with the United States would be beneficial only in the extraordinary case.

Furthermore, the Communists consider that international agreement on space telecommunications is closely linked to espionage. The earliest specific objection to international space communications agreement was voiced by Dr. G. M. Uspensky at the XIII Plenary Meeting of the International Radio Consultative Committee in Warsaw on September 13, 1956. Dr. Uspensky expressed the fear that agreement would lead to adoption of President Eisenhower's "open skies" proposal, which was regarded as an attempt to legalize the covert collection of intelligence on the Soviet Union.

A significant factor in Soviet policy evaluations may be the favorable geography of the Soviet Union, which makes international cooperation less necessary for the Soviets than for the United States. As Edward Wenk points out in the Senate Space Committee print, *Radio Frequency Control in Space Telecommunications*, "The great land mass of the USSR and the exercise of rigid internal discipline over emissions within its borders permits the Soviets to control use of the airwaves and thus to prevent harmful interference over a much greater portion of a satellite traverse than is possible within the more compact boundaries of the United States. That is, orbiting satellites are simply over Russian territory a longer time than over the United States. Both data-reception centers and tracking stations can be more widely separated than is possible in our country. Thus, through domestic control over spectrum use, the Soviets can be relatively well assured of freedom from interference, at least in certain bands." [7]

Mr. Wenk adds that the network of Minitrack stations established by the United States by treaty with countries throughout the world is subject to severe though unintentional interference from domestic stations in these friendly countries. The greater geographical coverage of the non-Communist world may be more than compensated for by the quality of tracking in the Soviet Union.

It is significant that in the case of radio astronomy, where the optimum bands permit electromagnetic scattering around the entire globe, the Soviet government proposed the reservation of a set of eight frequencies in advance of the Geneva meeting itself, whereas for other space-communications purposes the Soviets made no advance proposals whatsoever. And the Communist countries were the only ones which reserved the important 1660-1690 megacycle band to radio-astronomy (though only on a shared basis). [8]

Another factor limiting the Soviet interest in allocating bands for space communications may have been the unpopularity of such allocation among the smaller countries, particularly the under-developed countries, which have at best only academic interest in space communications. As these smaller countries develop, and even before they develop to the point where really effective use can be made of communications, the requirements of these countries for scarce radio spectrum will sharply conflict with the needs of space communications. Even the so-called "world-wide television," at least in the initial years, will operate through the distribution of program material for broadcasting from conventional television stations throughout the world and not from direct satellite-to-viewer transmission.

As the potential for propaganda by space-communications expands in the lesser developed areas, the best interests of the Soviets might call for freedom to compete with broadcasts from the United States. Regulations to prevent mutual-interference of opposing propaganda might well work more to the disadvantage of the United States than to that of the Soviet Union.

It may be anticipated that as the United States cooperates more and more closely with other countries in space-research, the Soviets will try to compete, for example by supplying better and cheaper boosters. If this occurs, the Soviets will probably find that further competition necessitates improved international cooperation and self-imposed limitations on Soviet space communications.

After giving this background in the necessity of international cooperation and the policy considerations motivating the Soviets in the field of space communications, I shall briefly trace the history of Soviet participation in the major steps taken toward cooperation in space communications.

The two organizations chiefly instrumental in facilitating this cooperation are the International Telecommunication Union and the International Astronautical Federation. The former is a semi-governmental and the latter a non-governmental organization. Both enjoy active participation by scientists from both Communist and non-Communist countries.

The International Telecommunication Union (ITU) is composed of two organizations known as the Administrative Radio Conference and the Administrative Telegraph and Telephone Conference. The International Radio Conference, which has responsibility for space communications, has two subordinate bodies: the International Radio Consultative Committee (CCIR), set up in 1932 to study and make recommendations on technical radio questions and operating procedures, and the International Frequency Registration Board, set up in 1947 to record and ensure international recognition of assigned frequencies. The CCIR is organized into 14 individual study groups, of which Study Group IV has been entrusted with study of the problems of space communications.

The ITU meets about once a decade. The CCIR meets in Plenary Assembly at intervals of about 3 years to consider specific recommendations submitted by any of its study groups and forward those recommendations which it adopts to the Administrative Radio Conference for deliberation and possible action. Proposals for action, originating either from the CCIR directly (possible only

(*Continued on page* 24)

A Non-Profit Corporation For Satellite Communications

SIGNAL STAFF REPORT

A NON-PROFIT COMMUNICATIONS satellite corporation should be established as soon as possible, with various measures being undertaken to insure that the corporation cannot be controlled by any single company. This corporation, which would be jointly owned by international common carrier companies, would establish an operational active communications satellite system by 1965 using medium or high altitude satellites, or a combination of the two types.

These are the main recommendations contained in the Ad Hoc Carrier Committee report, which was submitted to the Federal Communications Commission, October 12, 1961. Representatives of twelve international common carrier organizations who were invited by the FCC to patricipate as members of the Ad Hoc Committee prepared the comprehensive 57-page report. The companies represented were American Cable & Radio Corporation (Mackay Radio and Telegraph Company, Inc.; The Commercial Cable Company; All America Cables and Radio, Inc., and Globe Wireless Ltd.); American Telephone and Telegraph Company; Hawaiian Telephone Company; Press Wireless, Inc.; Radio Corporation of Puerto Rico; RCA Communications, Inc.; South Puerto Rico Sugar Corporation; Tropical Radio Telegraph Company; and The Western Union Telegraph Company.

President Kennedy, in a Statement on Communications Satellite Policy, July 24, 1961, urged that a global communications satellite system for "international communications services" be established "at the earliest practicable time." The FCC, in a Supplemental Notice of Inquiry, July 25, 1961, established the Ad Hoc Carrier Committee and requested that the committee prepare a report showing how a commercial satellite corporation should be established. The FCC specifically asked that the committee bear in mind that the satellite corporation would have to be established in such a way that no one company could "dominate or control the development, construction, management, operation or use" of the satellite system.

The committee, and the sub-committee and the task forces of the committee held over seventy meetings between August 3 and October 12, 1961. During this period, committee representatives met with representatives of various government and industry organizations to obtain their views and other information on the type of communications satellite system to be established, and the kind of corporation which would best be able to operate the system.

Joint Ownership

It was the consensus of the committee that the corporation should be a non-profit organization owned jointly by authorized international common carrier companies. Each company seeking joint ownership would provide $500,000 or more. These companies would each appoint two directors to the corporation. Companies which do not own, but which lease, satellite facilities would be allowed to appoint collectively one director to the corporation. The President of the United States or his representative would appoint three directors.

The satellites would be owned jointly by the authorized international common carriers. These carriers would include their investments in their rate bases for rate-making purposes, so that rates would continue to be established as at present under regulation by the FCC.

Although the satellites would be jointly owned, the ground stations to be used with the satellites would not have to be jointly owned. The report states that each carrier would be permitted to establish and operate its own ground stations, participate in joint ownership of ground stations with other carriers or rent capacity in other carriers' ground stations.

Recommendations

The report contains the following recommendations to insure that present and future international common carriers, whether or not such carriers are joint owners of the satellite corporation, would be able to use the satellite system under fair and reasonable terms.

"1. Participation in ownership would not itself entitle a carrier to use capacity in the satellite system . . .

2. Common carriers which participate in ownership and those which do not participate in ownership would be treated on an equal basis with respect to the opportunity to obtain access to the satellite system.

3. Any existing or future common carrier desiring to obtain the right of use of the satellite system would file an appropriate application for authority from the Commission in accordance with the provisions of the Communications Act.

4. Any common carrier should be accorded the right to use such capacity in the satellite as it may be able to show would serve the public interest, convenience or necessity. No carrier should receive permanent au-

(*Continued on page* 26, *col.* 3)

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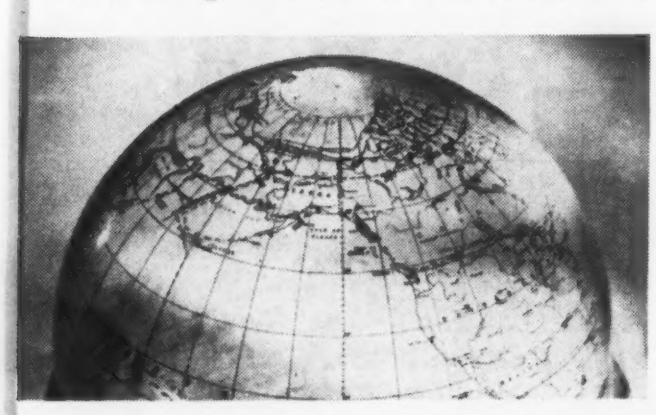

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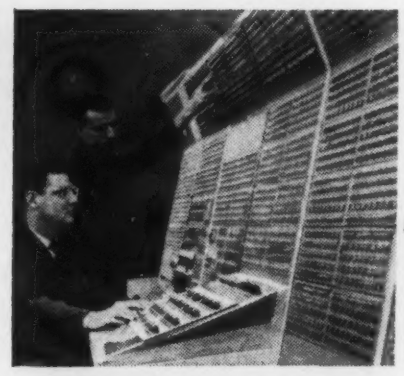

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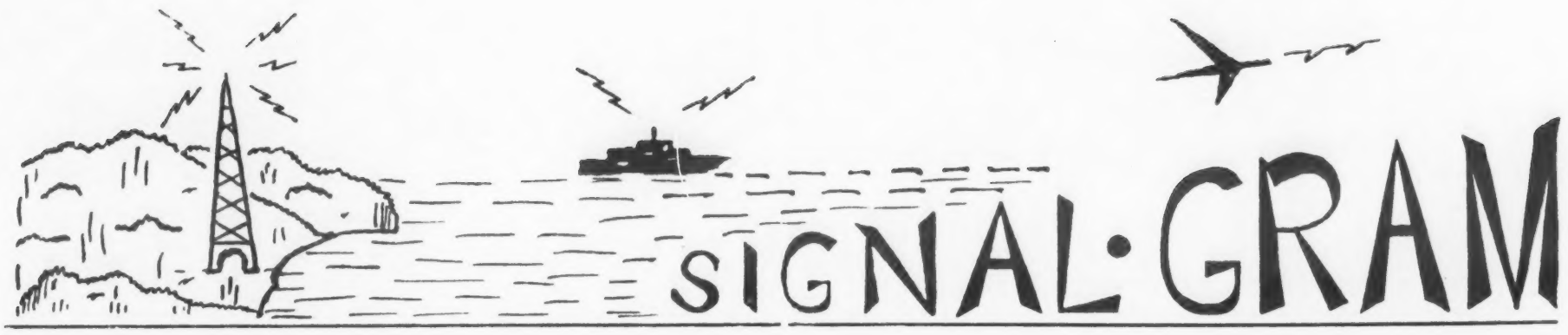

—GOVERNMENT—

NAVY VLF TRANSMITTER for communicating with the Fleet in the Pacific is being designed by Continental Electronics Manufacturing Co. To be located in Australia, the transmitter will be similar to the Navy's most powerful radio station, a 2-million-watt facility in Cutler, Me., for which Continental was prime contractor. The new very low frequency transmitting installation, designated "VLF Pacific," will be capable of communicating with all vessels, including submerged Polaris submarines.

DSA ELECTRONICS DIVISION will be established as soon as possible. Maj. Gen. Charles B. Root, USAF, who has been assigned to the newly established Defense Supply Agency, is directing the planning for the new division. A working group representing the Army, Navy, Air Force, Marine Corps and the Joint Chiefs of Staff met at Wright-Patterson AFB, Dayton, Ohio, to begin the project on Oct. 23, 1961.

SATURN ROCKET traveled 214 miles from its launch pad at Cape Canaveral, Fla., and reached an altitude of 84 miles in the successful flight test on Oct. 27, 1961, of the world's largest known space booster. The 162-foot rocket with its eight-engine power plant generated 1.3 million pounds of thrust during the brief flight. Chrysler Corp. has been awarded a $200 million contract from the National Aeronautics and Space Administration to produce this booster stage of the Saturn C-1 rocket.

MIDAS IV "spy-in-the-sky" satellite detected a Titan missile as it blasted off from its launching pad, Oct. 24, 1961. Infrared radiation from the rocket's exhaust was detected by the satellite-borne sensors less than two minutes after the rocket was launched from Cape Canaveral, Fla. The launching of the Titan, a missile capable of hurling a five-megaton nuclear warhead more than one third of the way around the world, was timed to coincide with the passage of the Midas spacecraft above Cape Canaveral. Fired into orbit Oct. 21, 1961, Midas is one in the series of satellites designed to eventually give the United States up to thirty minutes' notice of a large-scale ballistic missile attack.

SCIENTIFIC EQUIPMENT FOR COLLEGES will be provided by the National Science Foundation under a new matching fund program. Colleges and universities granting science bachelor degrees may request funds to assist them in purchasing scientific equipment to be used in the laboratory or in lecture-demonstration sessions. Examples of equipment eligible for purchase under the program include microscopes, centrifuges, microtomes, test equipment, and similar scientific apparatus. Proposals may not exceed $25,000 in order that the widest possible group of departments may benefit. All grants must be on a matching basis with at least 50 per cent of the direct costs to be incurred derived from non-Federal sources.

OPERATIONAL NAVIGATION SATELLITE SYSTEM may be one step closer with the successful launching on Nov. 15, 1961, of the Transit IV-B. Project Transit is designed to develop and demonstrate equipment to provide a reliable operational means of fixing the position of ships and aircraft anywhere in the world, and in all types of weather conditions, more precisely than previously possible, and to provide under any weather conditions more accurate means of maritime and aerial navigation than are now available. Transit IV-B, a 200-pound drum-shaped vehicle, is powered by a radioisotope thermoelectric power supply (SNAP), as well as by a main battery and an auxiliary battery with associated solar cells.

ATTACHED TO THE TRANSIT IV-B at the time of launching and separated once in orbit was a satellite called TRAAC (Transit Research and Attitude Control). This elongated doorknob-shaped satellite is designed to test the feasibility of using the earth's gravitational field to stabilize a satellite so that it maintains the same face toward the earth. This permits concentrating all antennas and power in one direction, which will mean increased signal strength, less demand on batteries and reduced workload of internal functional equipment. It should result in a longer operating life for the satellite.

SEVERAL POLARIS ITEMS OF INTEREST have come to SIGNAL's attention. The Navy has announced the names of two nuclear-powered Polaris submarines, now under construction and scheduled to join the Fleet in late 1963. SSBN-624 will be named Woodrow Wilson, after the 28th President of the United States. SSBN-625 will be named Henry Clay, after the Kentucky statesman. Several contracts for work on the Polaris weapons system were awarded to Lockheed Missile and Space Co. by the Navy's Special Projects Office during October. The company received the following contracts: $176.7 million for continued research and development of Polaris missile system; $22.9 million for production engineering and sustaining engineering services on tactical Polaris missiles; $7.4 million for production of advanced Polaris motors; $4.5 million for Polaris missile repair parts; and $1.7 million for Polaris static test vehicles.

AF COMMUNICATORS discussed the future development of the Aerospace Communications Complex (AIRCOM), the world-wide communications system which will, in the future, be operated by the Air Force Communications Service for all commands of the Air Force. Officially called the Senior Officers AIRCOM Advisory Group, the group met in October at Scott AFB, Ill., for its fourth conference.

COMPUTER COMPLEX is playing a key role in accelerating the flow of solid fuels for rockets and missiles to ships at sea and Naval bases around the world, the Navy reports. Said to be the only one of its kind, the system accepts information directly from a rocket motor in the firing bay and concurrently performs analyses of the motor's firing characteristics. In use at the Naval Propellant Plant at Indian Head, Md., the system consists of an RCA 501 computer and an Interstate Electronics Corp. data gathering unit. The system makes it possible to perform instantaneous calculations of propellant and motor performance that would be impractical by other means, it is said.

TWO DOD RESEARCH & ENGINEERING POSTS were filled during the month of October. Bruno W. Augenstein, who was Director of Advanced Planning at Lockheed Missiles and Space Co., has been appointed Assistant Director of Defense Research and Engineering for Special Projects. James F. Drake has been named Deputy Assistant Director of Defense Research and Engineering for Limited Warfare Systems. Mr. Drake formerly served as Director of Aerospace Propulsion Systems Analysis Department at the Marquardt Corp.

SOUND TRANSMISSIONS over a wide range of depths will be studied by an unmanned research vessel being developed at the Naval Ordnance Laboratory, Silver Spring, Md. Called SPAR (Seagoing Platform for Acoustics Research), the 350-foot tube-like ship will be partially sunk in a vertical position anywhere on the high seas to serve as a stable platform for conducting acoustics research. Underwater listening devices called hydrophones will be attached to the exterior of the vessel.

NO FURTHER TESTS OF PROJECT WEST FORD are planned at this time, the Air Force reported last month. Prior to the unsuccessful test on Oct. 21, 1961, President Kennedy stated that additional tests would not be made until the results of the first test were analyzed. In the first test 350,000,000 copper filaments, held in a 75-pound canister, were launched piggyback aboard a Midas satellite. Telemetry information indicated that the canister was released from the satellite. The copper wires were embedded in a coating on the canister that was to evaporate within two days after launching and the wires were to fall out gradually and form a belt which could be used for relaying high frequency signals. Scientists at the Massachusetts Institute of Technology who are conducting the experiment for the Air Force have not been able to locate the copper wires in space. It is believed that the wires were not released from the canister. As we go to press, MIT is continuing its search for the wires. The announcement in last month's SIGNALGRAM, which reported that the metallic belt was being formed, was inserted at the last moment prior to publication. At that time it was not known that the experiment would prove unsuccessful.

CONTRACTS: ARMY: Western Electric Co., production of ground equipment for Nike-Hercules guided missile system, $20.4 million; Radio Corporation of America, production of new front line walkie-talkie radio units, $9 million. NAVY: Westinghouse Electric Corp., design, development and production of nuclear reactor compartment components for two nuclear-powered attack submarines, $16.7 million; Grumman Aircraft Engineering Corp., design and construction of hydrofoil research ship, $11.9 million. AIR FORCE: International Business Machines Corp., production of bombing navigation system components for B-52 aircraft, $13.1 million; Hallicrafters Co., production of communications equipment for B-52 aircraft, $8.3 million (2 contracts); Massachusetts Institute of Technology, continuation of work on high field magnet laboratory, $2.5 million.

ASK ALPHA:

What's being done to perfect satellite relay for long-range communications?

Many things. An active development program is making material progress toward low-cost systems for communication by passive reflector satellites. / Another project is development of facilities, techniques, and equipment for ground-space-ground transmission of multiple-channel voice and high-speed data./ There's a new 60-foot diameter antenna of very high precision. ☐ It's all happening as part of a continuous program in communication via satellite being carried out by Alpha Corporation and the parent Collins Radio Company. ☐ The antenna—a steerable, parabolic system—is being installed at Alpha's space communication research station in Dallas. Here, the Space Systems Division is enlarging on experiments which already have used the moon and Echo I as relays in worldwide communication circuits. Next step: to transmit multiple channel voice and high-speed data between the U. S. and England, France, and South America, using active repeating satellites and multiple passive reflector satellites. ☐ There's much more to tell. And it's well worth hearing, if you're seeking new techniques, new facilities, or broad systems capability in space communication. Ask Alpha!

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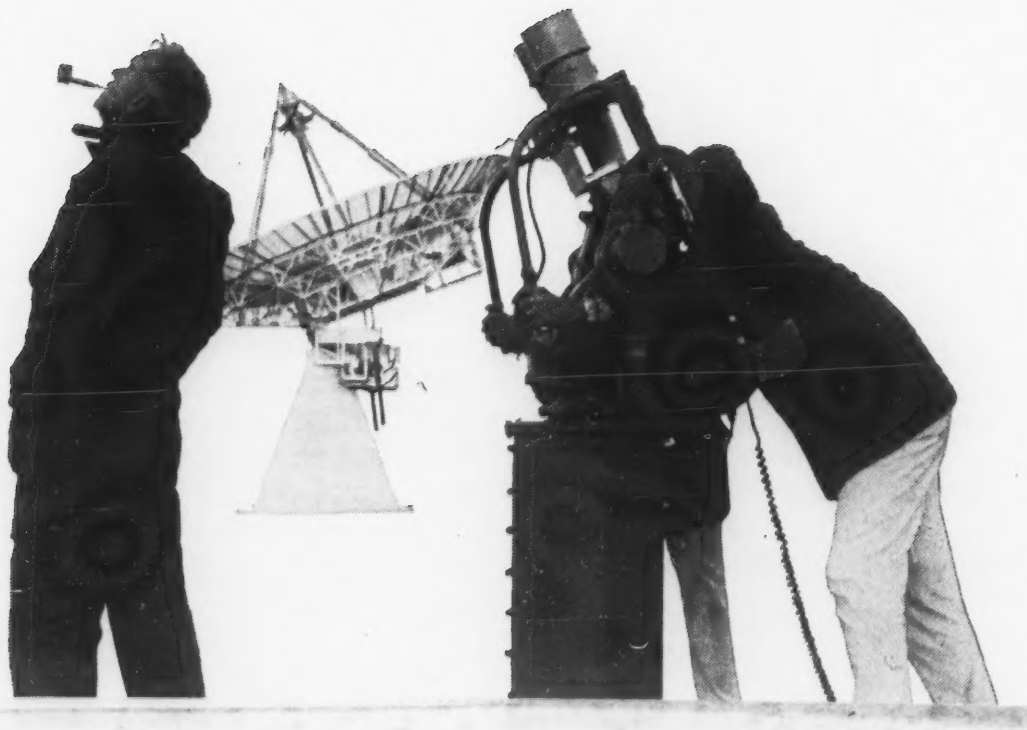

MINNEAPOLIS-HONEYWELL REGULATOR CO. has opened a $5 million aerospace facility in Minneapolis for the production of interplanetary guidance equipment. The facility contains a computer center believed to be the first in industry that can perform scientific computation of an analog and digital nature while simultaneously handling business problems.

WESTERN UNION TELEGRAPH CO. will spend $355 million in an expansion program to be completed within the next few years. The proposed expansion, to be largely completed by 1964, includes, a transcontinental microwave system; a data communications system for the Air Force; and a two-way, direct dial customer-to-customer teleprinter system. The expansion program was announced during a ceremony commemorating the 100th anniversary of the company's founding.

NEW POWER CONVERSION METHOD is being studied by Westinghouse Electric Corp., under a $75,000 contract awarded by the Air Force Aeronautical Systems Division. Westinghouse engineers discovered that certain metals separated by a porcelain enamel produce electric power when heated. By inserting thin plates, shaped like slices of bread, in a household toaster, power enough to drive a small electric motor and its propeller was produced. Even though removed from the heat source, the plates continued to produce electricity as long as stored heat remained. The first applications of this new development are expected to be in missile and space work.

LABOR SURPLUS AREAS received over 80 per cent of the procurement dollars spent by the Martin Company's Baltimore Division during the six-month period ending Sept. 30, 1961. Martin, cooperating in government efforts to increase employment across the nation, last spring placed added emphasis on procurement of supplies, equipment and services from businesses in government-designated labor distress areas. From April to September, Martin spent almost $36 million in the nation's labor surplus areas. Of this amount, almost $8 million,or more than a fifth of the funds went to business firms in Maryland labor distress areas.

AUTOMATIC LANDING SYSTEM now under development may provide an answer to the problem of how to recover and land boosters and payloads of orbiting and interplanetary vehicles. The system, being studied by the Defense Systems Dept. at General Electric Co., is designed to locate a vehicle on radar at a 500-mile range, calculate a safe flight path to avoid overheating or over-stressing the vehicle, and guide the vehicle to a pre-designated runway.

AUERBACH CORP. has deleted the word "Electronics" from its company title. The change was made to show the firm's broad scope of work in all aspects of information sciences and technology.

NAVY SONOBUOY CONTRACTS have been awarded to the following five firms: Magnavox Co., $22.1 million; Sparton Corp., $8.2 million; Motorola, Inc., $6.3 million; Hazeltine Corp., $4.7 million; Sanders Associates, Inc., $2.1 million.

ARC HEATER which will simulate the extreme conditions met by missiles and spacecraft re-entering the earth's atmosphere has been ordered by the National Aeronautics and Space Administration from Westinghouse Electric Corp. The arc heater, said to be the most powerful ever made, and its direct current power supply valued at slightly more than $1 million, will be used at NASA's Langley Research Center. By simulating the re-entry environment, engineers will be able to study the re-entry problems of space vehicles.

AMPHENOL-BORG ELECTRONICS CORP. has combined its two microwave divisions, FXR and RF Products, into an enlarged unit to be known as FXR. "Our deepening penetration of the fast growing microwave market will be intensified by the new division operating under a single management with augmented research and engineering capabilities and product lines," a company official stated.

ANALYSIS OF SELF-ADAPTING COMMUNICATIONS SYSTEMS will be conducted by the Applied Research Lab. of Sylvania Electric Products Inc. Object of the program, which is being initiated under an Air Force contract, is to study methods of improving communications by adapting the transmitter and receiver to changes which occur in the transmission channel. These changing conditions include signal fading and varying noise levels.

—GENERAL—

RESEARCH SPENDING in the United States will amount to almost $16 billion in 1962, predicts Dr. George W. James, an economist at Battelle Memorial Institute in Columbus, Ohio. Dr. James estimates that the government will spend about $10 billion for research next year, reflecting stepped-up space and defense programs; industry about $5.5 billion, up $600 million from the 1961 estimate; and universities and foundations about $350 million.

WOMEN IN SCIENTIFIC CAREERS are few in number, according to a report recently issued by the National Science Foundation. The report is a compilation of available data on the training and employment of women in various scientific fields, and a brief study of the factors controlling women's selection of and participation in scientific careers. Although women are becoming an ever larger proportion of the total labor force, science ranks far down on the list of professions that they have thus far entered. Only about 4 per cent of all federally-employed scientists and engineers are women, the report states, and about 7 per cent of a total of over 166,000 registrants in the National Register of Scientific and Technical Personnel are women.

NASA-UNIVERSITY SCIENCE PROGRAM has the two-fold objective of encouraging university science departments to pursue research in the space sciences and stimulating industry to make use of the technology resulting from space exploration. The program, which is aimed at expanding science, education and industry in a six-state Middle West region, was announced jointly by the National Aeronautics and Space Administration and the Midwest Research Institute. NASA will learn from MRI what Middle West area skills and facilities are available for advanced research, graduate education, and manufacturing. In turn, scientific information from NASA will be relayed or interpreted by MRI's scientists to regional industries and universities in Arkansas, Iowa, Kansas, Missouri, Nebraska and Oklahoma.

PERT II SYSTEM is being used to accelerate missile design and development programs by enabling defense program managers to define and integrate what must be done to accomplish research and development objectives on time. An advanced version of PERT I (Program Evaluation and Review Technique), the computer system pinpoints the critical elements in a project and develops an estimate of the chances of meeting the predetermined schedule.

SATELLITE DISPLAY SYSTEM is undergoing final testing at the Spacetrack Research and Development Facility at Laurence G. Hanscom Field, Bedford, Mass. Satellite tracks are visually presented on the face of a large-screen cathode ray tube on which a transparent Mercator's projection-overlay of the earth is superimposed. Six satellite tracks can be displayed at the same time. After final testing, the device will be used as an aid in the development of advanced display systems for use in the North American Air Defense Command's space detection and tracking system.

INFORMATION ON ANTARCTICA is being compiled by Science Communication, Inc., under a $28,905 contract from the National Science Foundation. The company will find out what information is needed by persons interested in scientific work in the Antarctic region, and what sources they have available to them.

BROADCASTING OF U.N. GENERAL ASSEMBLY SESSIONS is being made possible by American Machine & Foundry Co., AMF International. The Worldwide Broadcasting international short-wave station WRUL beams the proceedings of the 16th General Assembly around the globe, making them available for rebroadcast in the United States and abroad without charge.

RUSSIAN UNIVERSITIES pay a scientist three or four times as much as he could make doing research for industry. Thus Soviet industrial research laboratories are finding it difficult to attract scientific personnel, according to information which the Office of Technical Services of the Business and Defense Services Administration has received from Russian technical papers.

COMING EVENTS:

DEC. 12-14: Eastern Joint Computer Conference, sponsored by American Federation of Information Processing Societies, Sheraton-Park Hotel, Washington, D. C.

DEC. 26-31: Annual Meeting of American Association for Advancement of Science, Denver.

Bionics For Aerospace Supremacy

by Jeremy K. Schloss

The author was formerly Chief, Electronic Technology Laboratory, Aeronautical Systems Division, Air Force Systems Command, Wright-Patterson Air Force Base, Ohio. He is now Technical Advisor, Aerospace Division, The Boeing Co.

MY PURPOSE is to give scientists and engineers an appreciation for, an understanding of, and a desire to participate in, Bionics, the latest research and development effort toward Aerospace Supremacy.

Bion and *ics* combine to translate into "like living" which is better stated for our purpose as, "functioning like living things."

Specifically, Bionics is that new science wherein the field of medicine writes, in mathematics, the prescriptions to be filled by the field of electronics. First, I shall discuss a few specific aerospace problems which should clearly show the need for this new science and then indicate the philosophy underlying our approach. Bionics used to be the subject of skeptical and facetious discussions. The skeptics and comics have dwindled as new disciples are added to the ranks of the believers but we now find most of our followers confused as to where each discipline starts and stops and what shape our future creations are to take. After my philosophical excursion, I will differentiate among the biological and mathematical and electronics areas of responsibility while taking cognizance of those so-called "gray" or overlapping areas. Finally, a short word about our progress to date as well as our short and long-range plans.

Some Aerospace Problems

Let us look at just a few problems in which aerospace vehicle operators need assistance. Cluttered communications channels, aerospace collisions, planetary landings, identification of friend or foe, and missile combat become more real as space vehicles become more successful.

There has been much publicity given to the problem of the crowded electromagnetic spectrum and the need for broad, clear channels for video and data transmission. For our missiles and satellites to be controlled continuously from the earth would take large numbers of internationally-agreed-upon, interference-free, broadband channels. Should our aerospace vehicles transmit back to us any and all information without discrimination it would require additional similar channels. The simple, obvious solution of pre-programming is too inflexible in its inability to anticipate unforeseen situations. However, the vehicle should have at least a minimum of programming which will assure success of the basic mission and it must have a device capable of discriminate selection, and even collation and evaluation of data before transmission to earth. Reliability is the obvious handmaiden of such a device.

The ability to avoid obstacles such as other missiles or satellites or astral bodies and to translate the vital statistics of those obstacles to earth, friendly missiles and satellites, on the appropriate frequencies with the proper code, is essential whether our unit is manned or unmanned.

Pilots or controllers, either in the vehicle or on the ground, physically react to stimuli in the order of several seconds. Two space vehicles closing at the rate of 18,000 miles per hour are actually moving toward each other a distance of 10 miles in 1 second. Our device must have components capable of nano-second (10^{-9}) or pico-second (10^{-12}) reaction time in order to provide the necessary interval for computation, evaluation and decision. Solid state components and devices, as exemplified by the molecular electronics concept, have opened the door for such sub-second switching times, reduction in bulk, and improvement in reliability of the intricate devices we envision.

Actual planetary landings should only be accomplished with a full awareness of all the physical and political ramifications. Our vehicles cannot hover in a dissident atmosphere while an earthbound controller reviews all the transmitted data (assuming it got through) and makes the necessary decisions. Even a two-second delay in signaling the vehicle to withdraw could be catastrophic. Our device must prohibit complete destruction and it must be able to continue functioning logically and efficiently despite partial destruction. Eventually, the requirement will be for self-repair and hence a reduction in the number of stand-by components and circuits.

When our missile meets a similar missile it must not be "Auld Lang Syne" for both—but only for one. Our missile must counter the actions of the enemy missile which means our device must have an ability to take all its old experiences and theories and deliberately restate them in terms of new data for a completely unprecedented formula for combat.

The application of such capabilities to the broad areas of communications, navigation, guidance, intelligence, reconnaissance and surveillance in aerospace as well as on and under the surface of the earth is obvious.

A device with the potential to accomplish the above tasks exists today but has several defects. It reacts too slowly in comparison to vehicle speeds, and it requires excessive pampering. It is capable of performing all of the essential functions but I doubt very much if the present model of man can be much improved upon, at this time, by man himself. Within our mortal limitations it then becomes necessary to make devices which perform living functions using components controllable by man. It is not our intention to recreate living organisms but rather to simulate certain of their superior functions. We

can envision devices to provide the information comparable to that made available by seeing and hearing for the blind and deaf. Note that I did not say we will give sight to the blind or hearing to the deaf, but rather that the desired information will be provided. A few examples may clarify this philosophy. Man has wanted to fly like a bird, hear under water, see objects in the distant sky and detect enemies in the dark of night since time immemorial. The airplane, sonar, radar and infra-red detectors do these functions but not by recreating the shape of a bird or a fish or the eye. We should like to understand the principle of navigation and evasion as employed by the porpoise or the bat. We should like to understand the principles of parts replacement as practiced by the crab or even trees, but only God can make a tree—we will concentrate on function simulation!

There are many other useful functions whose mechanisms are not completely understood by science. How do we think? How do we learn? Why is the cochlea in the ear selectively frequency sensitive? The basic questions, in each instance, are: "What determines the molecular structure of each device?" and "what is that structure?"

Scientific Responsibilities

We have now arrived at the moment to define the specific goals in our science of Bionics and delineate the areas of responsibility. "Bionics is the technology that realizes, through the *study* of living systems, the *creation* of electronic systems that *perform* in a manner *analogous* to the more sophisticated functions of living systems."

For military purposes, the field of Bionics could be represented as a large Pandora's box fed at its input terminals by the mysteries of organic systems and giving off automatic military hardware at its output.

What makes this approach new? There have been recorded many attempts to make automated images of man as far back as the Old Testament. The bibliography of any learned paper on automation will supply innumerable examples of efforts to attack a specific isolated program. (1) However, as far as I can determine, the Bionics program of the USAF is the first concerted effort on the part of all scientific disciplines to pool their resources in clearly defined channels towards the single goal of artificially simulating living functions electronically.

Most of the life and physical sciences are represented in this all-out effort. During the period 13-14-15 September 1960, the Wright Air Development Division sponsored the first all-inclusive symposium in the science of Bionics. It was attended by 693 leading engineers and scientists and included world-renowned doctors of medicine, biology, physics, mathematics and electronics.

A rough breakdown of the symposium follows: Engineers—330; Physicists — 28; Psychiatrists — 6; Biophysicists—13; Mathematicians—69; Psychologists — 57; Reporters and others—100.

Our search for the multifunction machine is being performed by humans who do not have skills in every field and usually understand only the language of their own science. It was concluded at the Wright Air Development Division symposium that scientists not only recognized the overwhelming need for inter-disciplinary coordination but were now anxious to participate in cross-science learning of both skill and language. Until the Bionics millennium when one individual is capable of doing his own analysis, formulating his own mathematical models and designing and constructing his own electronics functional prototypes, I am resigned to the fact that delineation of specialized research areas will continue to be the modus operandi.

Such division of responsibilities can now be easily understood in the light of our philosophy to simulate living functions rather than to attempt to duplicate them. The three areas, for our planning purposes, are known as Medical Bionics, Theoretical Bionics and Engineering Bionics.

Medical Bionics studies the functions of biological systems to determine their underlying principles and molecular structure. This work is within the province of the bio-physicist and has been continuous in varying degrees, throughout the ages.

Theoretical bionics will attempt to translate the findings of the medical Bionics researchers into mathematical models. Here the area is shared jointly by the medicine men and the electricians. The doctor will use these models to refine functions in the biological systems—and the engineer will depend upon the formulae to develop physical, non-living systems which will function in a manner characteristic of the living system. Examples which come immediately to mind are automatic data processing, command and control, self-organization, self-programming, learning and reliability through self-repair, redundancy and self-adaptation.

The theoretical approach is relatively new. The dependence of electronic research on mathematical models derived from living organisms is the newest phase of research which will be undertaken by the Electronic Technology Laboratory of Aeronautical Systems Division's Directorate of Advanced Systems Technology.

The engineer's results will find an avenue back to the medical Bionicist to aid him in further refinements of biological systems and mathematical models. The major output of the Bionics engineer, however, will be in aerospace weapons systems.

Progress and Plans

Having touched lightly on why we need Bionics and how we intend to achieve our results, it now remains to show what has been accomplished so far, and what the future holds.

Dr. Reichardt, a German biologist, did a detailed study of the unusual functions performed by the eyes of the beetle and transferred these functions into solvable mathematical models. (2) These formulae were translated into electronic circuits to give us a velocity over height indicator for use in aircraft and is being tested by Aeronautical Systems Division engineers.

The Rand Corporation studied a group of students to determine their methods for solving problems including their illogical approaches and hunches. (3) The system derived was used as a basis for problem solving by computers which had incorporated the human trial and error method but still enabled the computers to forecast final correct results without their being programmed for any specific program.

The University of Illinois has succeeded in defining the functions of the cochlea of the ear in mathematical terms and are on the threshold of a new device that will provide hearing sensations for those persons with injured cochlea. This is an example of the electronics feedback to biological research.

Dr. McCulloch of Massachusetts Institute of Technology has done some remarkable work in analyzing the functions performed by the retina of a frog's eye. (4) The fact that a frog can only see an object which moves relative to its background is useful in solving our present radar and future space-vehicle-identification problems. Once a target has been identified it could be electronically blended into its background so that only new unidentified targets would be significant. The relatively crude

(*Continued on page* 28)

Practical, High-Speed Facsimile for the High Priority Messages and Graphics of Government, Industry & Commerce

Alden facsimile communications equipment coupled with modern tape units has the ability to store at one speed and transmit at another to give complete flexibility to any systems layout.

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New speed flexibility makes possible entirely new network concepts!

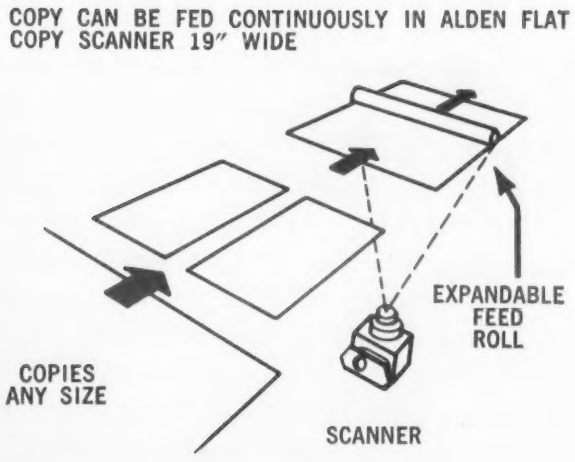
The ability of Alden facsimile to operate at all speeds and to translate between speeds through tape permits the use of high speed cores circulating high volumes of information to various receiving points where selected transmissions can then be sent out at normal speeds to lower volume points.

This ability of Alden facsimile to most perfectly match the message load and the communication links permits highest utilization of circuit time — thus greatest network efficiency.

Alden equipment handles the entire spectrum of high priority graphic information.

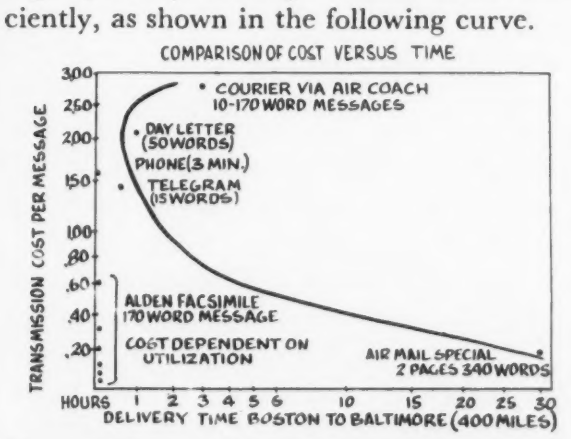
Not restricted to letter size copy, Alden Flat Copy Scanners readily accept originals of any length, width or thickness. They have the flexibility to transmit everything from full scale layouts and plan drawings to 2 letters at a time or small size messages whether shingled or in parallel. Messages can be fed continuously or selectively scanned for greatest flexibility. The tremendous variety of messages that can be sent results in highest utilization of equipment for all your message traffic between operations points.

High priority, graphic communication data covering the full spectrum of business messages — from full scale drawings to two letters at a time — are examined at a demonstration of Alden High Speed Facsimile.

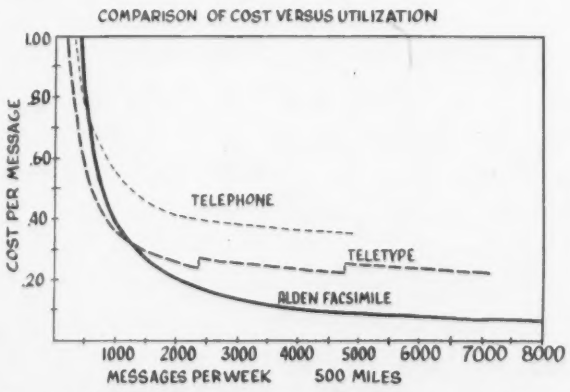


Costs are lower than you might think!

You may already be paying the cost of facsimile communications if you're sending even a small quantity of high time value, high priority messages by telegrams, couriers, special delivery, etc. between two points. On an error-free, fastest brain-to-brain basis Alden facsimile can handle the high priority message traffic more efficiently, as shown in the following curve.



Your high priority message traffic alone may justify Alden facsimile but because of its ability to handle messages and graphics of all sizes and shapes by transmitting all your message traffic between two points you may build up your message volume to where Alden facsimile is less expensive than other conventional communications means as shown below.



Beyond 1200 messages per week (170 words per message transmitted 500 miles) Alden facsimile is less expensive than teletype when message preparation costs are figured.

If you're presently sending high time value messages or if you have large quantities of general messages and graphics of all sizes between operations points — Wire or phone today for the Alden General Purpose Communications Survey sheet. This will allow us to make a communications study and cost analysis that will illustrate clearly what Alden facsimile can do for you.

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Space Communications (*Continued from page* 13)

since 1959) or from individual countries, if adopted by the Conference, are then referred back to the individual countries for ratification as a multilateral treaty.

The International Astronautical Federation (IAF) was organized in 1951 after a world congress of astronautical societies had shown the need for a world-wide organization to promote the achievement of space flight as a peaceful project, to facilitate exchange of ideas and collaboration on research among interested people throughout the world, and to stimulate public, university, and governmental interest in the solution of the problems of space flight.

The IAF functions through annual Congresses, arranged by a permanent secretariat, and through subordinate functional bodies. The body most concerned with space telecommunications is the International Institute of Space Law, which has eleven subordinate working groups, of which Group 7 is charged with the formulation of proposals on space radio for possible submission to the CCIR for international action.

The Soviets were invited several times during the early 1950's to join the IAF, because of the Russians' 25 year history of organized interest in astronautics, and because of increasing concern that the Federation, perforce, was becoming oriented toward the West.[9] In August 1955, four months after the Soviets announced the organization of the "Interdepartmental Commission for Interplanetary Communications," the Soviets sent two members of the Soviet Academy of Sciences, L. I. Sedov, President of the Academy's Commission on Astronautics, and Prof. K. Ogorodnikov, as observers to the VI Congress of the IAF in Copenhagen. In the following year the Commission on Astronautics of the Academy of Sciences became a formal member of the IAF and in 1959 Dr. Sedov became President of the IAF. Upon the occasion of his elevation to the presidency, Dr. Sedov announced that, "On my part I shall try to make every effort toward the extension of international cooperation in the field of astronautics and the achievement for the IAF of greater influence in the development of the science and technology of interplanetary communications."[10]

Although the Soviets have not yet joined the International Institute of Space Law, which was founded last year, the space radio working group is made up of leading specialists from Communist countries, including the distinguished Prof. Manfred Lachs of Poland, Dr. Jan Busak from Czechoslovakia, and Prof. József Iványi of Hungary.

The International Astronautical Federation initiated its program for the development of a plan to control the use of radio in outer space with a formal proposal to the International Telecommunication Union (ITU), dated April 16, 1956. The IAF urged that working arrangements be set up between the IAF and ITU "looking toward the optimum plan for allocation of frequencies in the radio spectrum for . . . communications in outer space."

The IAF proposal contained a five point plan along the following lines:

1. The International Radio Consultative Committee (CCIR) of the ITU should study the *requirements* of radio in space.
2. The International Frequency Registration Board (IFRB) of the ITU should study the *frequencies* available to meet the requirements developed by the CCIR.
3. The IAF should send representatives to the sessions of the CCIR and the IFRB.
4. The ITU should send representatives to the IAF's meetings—including the Rome Congress on earth satellites and space flight, September 1956.
5. After completion of the four steps outlined above, the ITU should initiate formal steps to effect radio allocations for use in space.

The ITU responded negatively to the IAF proposal. On June 11, 1956, the Secretary-General of ITU advised the IAF that the Union viewed the matters raised by the IAF as appropriate for the administration of individual member nations.

Thereafter the IAF renewed its proposals—both in presentations to the ITU itself and in proposals to the constituent organizations of the ITU. The first of the latter category to which a formal proposal was made was the CCIR.

The International Astronautical Federation, on September 3, 1956, submitted to the CCIR a proposal that the CCIR establish a new Study Group for extra-terrestrial communications. In this proposal the IAF reviewed the progress up to that time in earth orbital satellite programs, and in the development of Cislunar and Circumlunar space vehicles. In the IAF proposal the importance of radio communications and guidance in such space flight activities was also discussed.

The IAF document concluded with the statement that the CCIR is the only international body authorized to study the subjects of communications and guidance in extra-terrestrial projects. The IAF urged that such a study be completed and a report rendered in time for presentation to the International Radio Conference of 1959 (Administrative Radio Conference, International Telecommunication Union, Geneva, 1959).

The Chairman of the IAF's Committee on International Affairs traveled from the United States to Warsaw to attend the sessions of the CCIR and to urge the adoption of the IAF plan.

The CCIR at its Thirteenth Plenary Meeting, Warsaw, September 13, 1956, responded officially to the IAF proposal by causing its Director to suggest that the IAF apply for membership in the CCIR. The Administrative Council of the ITU at its May 1957 session voted to include the International Astronautical Federation in the list of international organizations to be notified of the 1959 Radio Conference and to be allowed to participate therein. Thereafter on December 30, 1957, the IAF renewed its proposal that the CCIR set up a Space Communications Study Group.[11]

Although a study group specifically designated for space communications was not set up until April 1959, a year and a half after the advent of the space age, the IAF participated in various other study groups during the year 1958 to draw attention to the need to study specific requirements for space telecommunications for consideration by the forthcoming ITU Administrative Radio Conference to be held in Geneva in the latter half of 1959.

The president of the IAF represented the IAF at the May 1958 meeting of CCIR Study Group XI (Television) and submitted Document VI/87 on the question of space communications to the meeting of Group VI (Ionospheric Propagation) in Geneva in July and August 1958. "As a result of representations made with the support of Document VI/87 by the president of the International Astronautical Federation, an international organization now accredited to the ITU, it was decided that the question should be put directly to administrations . . . with the hope that responses might be received in time for consideration at the IXth Plenary Assembly [of the CCIR in April 1959] in Los Angeles."[12]

As reported by Mr. Wenk, "By the time of the 1959 Los Angeles meeting, a solid background had developed."[13]

At the Los Angeles meeting the CCIR established Study Group IV entitled "Space Systems" to "study technical questions regarding systems of telecommunication with and between locations in space," and adopted several recommendations concerning the selection of frequencies for space communications for action at the ITU Administrative Radio Conference in Geneva from August to December 1959 and at the Plenipotentiary Conference of the ITU held concurrently from October to December 1959.

Although the Soviets did participate actively in the IAF and showed sympathy with the interest of the IAF in protecting space communications, the Soviets made no proposals in this regard prior to the Geneva conferences either through the IAF or directly to the CCIR, other than for the allocation of bands for radio-astronomy.

Indeed, the Soviets intentionally violated whatever international agreements had been made to regulate space communications. Although the Special Committee of the International Geophysical Year adopted the 108 megacycle frequency for satellite communications, the Russians chose 20.005 and 40.002 megacycles respectively for Sputniks I and II and 19.997 and 183.6 for Lunik. Certain of these transmissions were on frequencies adjacent to those set aside previously by the International Telecommunication Union for standard frequency use, and some interference with these signals has been alleged at receivers during the brief interval the vehicle was overhead.[14]

Although the illicit frequency selection by the Russians has been widely discussed and criticized, it is often overlooked that our own satellites have used frequencies allocated to safety and to aeronautical radio services for the safety of life and property in the air, as well as part of a commercial FM frequency.[15]

The violations of the Soviets have not been serious, nor need one expect serious violations in the future, because the cost of experimental launchings is so great that only extremely unusual circumstances would call for the use of a channel already occupied by broadcasts which might destroy the entire experiment.

As pointed out earlier, the lack of serious interference caused by Soviet space vehicles and satellites to earth communications is a principal reason why the Soviets regard their space broadcasting as legal. The case may and has been made that the IGY Agreement may be considered as advisory and that prior to the December 21, 1959, adoption of the new Radio-Communication Regulations by the ITU, containing allocations for space communications, there was no international space communications law at all. It may be argued that even the above Radio-Communication Regulations did not become law until they formally went into effect (for signatory parties) on May 1, 1961. And, as indicated previously, because the results of the 1959 ITU conferences conflict with the position of the USSR, the Communists regard these results anyway as strictly provisional.

In their declaration of October 9, 1959 (Document #230) at the Administrative Radio Conference, the Soviets stated that "Even though space research is very important from the scientific point of view, there certainly will not be enough space rockets in the near future to justify the allotment of special frequency bands, especially since it has not yet been scientifically determined which frequency bands would be suitable."

The reservations of the Soviet Union and Czechoslovakia to the proposals of Study Group IV, established at the 1959 Conference, run in a similar vein and are contained in Document #369, which states that, "as yet not enough experience and scientific foundations are available to determine frequency needs for the purpose of space research and a premature international regulation of frequency requirements over 200 megacycles would possibly restrict the initiative of scientists and technicians, who are still studying the problem and are to select the most suitable frequencies for communications between the Earth and space."

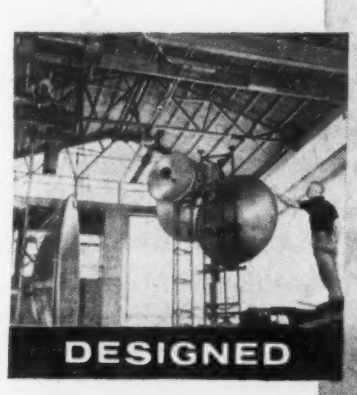
A positive result of the Communist position, however, is the recognition given to the demands for international regulation in the field of space communications and the recognition of the dynamic character of space research, evidenced by the Communists support of Recommendation No. 35 of the 1959 Administrative Radio Conference, which calls for the convening of an Extraordinary Administrative Radio Conference in 1963 devoted explicitly to space communications. The recognition that further consideration of international regulation of space communications cannot wait until the next Ordinary Administrative Radio Conference several years from now, is itself cause for optimism.

Thorough preliminary work during the next two years by the International Astronautical Federation (IAF), the International Astronomical Union (IAU), the International Scientific Radio Union (URSI), and by two new organizations, COSPAR and the U. N. Committee on the Peaceful Uses of Outer Space, which became interested in space communications after the 1959 Los Angeles meeting had laid the ground-work of space communications law, should be able to assure the success of the 1963 Extraordinary Administrative Radio Conference on Space Communications.

Failure to agree on international regulation and registration of frequencies used in space communications may result in the accidental triggering of World War III. Progress in such agreement may contribute significantly to the growth of genuine cooperation and peace with justice among nations.

4. Jan Busak, "Radiokomunikace a kosmicky prostor," (Radio-Communications in Outer Space), Casopis pro Mezinarodni Pravo, Vol. 3, No. 4, Fall 1959, pp. 349-359, Prague; reproduced in English in "Legal Problems of Space Exploration, A Symposium," Senate Document No. 26, 87th Congress, 1st Session, December 31, 1960, 1392 pp., see p. 1132.
5. *Ibid.*, p. 1128.
6. George B. Kistiakowsky, *Department of State Bulletin*, February 22, 1960, p. 270.
7. *Ibid*, footnote 3 *supra*, p. 50. (See Part I)
8. *Ibid*, footnote 3 *supra*, p. 51.
9. F. C. Durant, III, "The First Decade of the International Astronautical Federation," 63 pp., Research and Advanced Development Division, Avco Corporation, Wilmington, Massachusetts, August 1959, p. 10.
10. *Ibid.*, footnote 1 *supra*, p. 33 (See Part I)
11. Andrew G. Haley, "Space Communications and Astronautical Radio Activities and Proposals of the American Rocket Society and the International Astronautical Federation," 26 pp. mimeo., pp. 17-19.
12. "United States and International Action in CCIR and ITU on Space Telecommunications," 66 pp. mimeo., Department of State, Telecommunications Division, TD Serial No. 908, CCIR, Doc. No. 26, June 10, 1960, p. 2; also "Report of the United States Delegation to Study Group VI," TD Serial No. 892, December, 1, 1958.
13. *Ibid*, footnote 3 *supra*, p. 45.
14. *Ibid*, footnote 3 *supra*, p. 40.
15. Andrew G. Haley, testimony before the House Committee on Science and Astronautics, "Satellites for World Communication," 122 pp., Hearings, 86th Congress, First Session, March 3-4, 1959, p. 97.

COMMUNICATION TOWERS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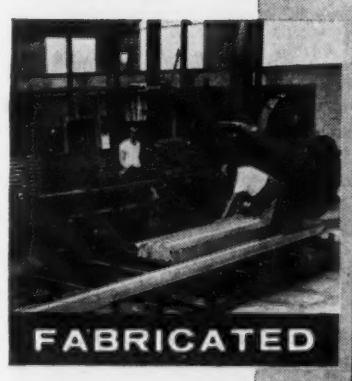
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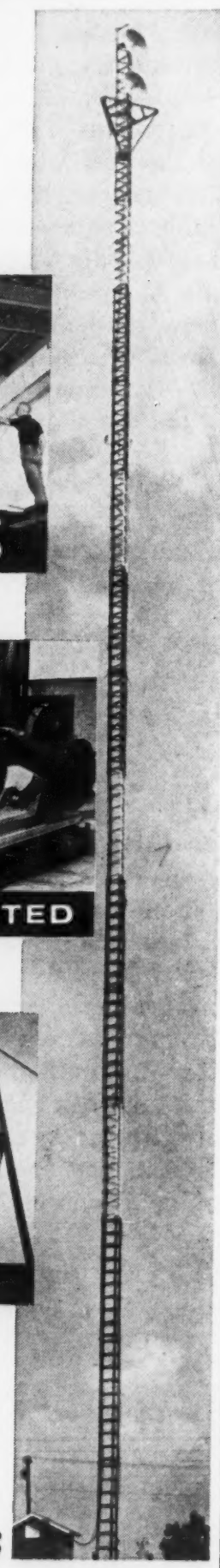
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Role of Scientist

(*Continued from page 7*)

My third proposal was to identify talented individuals and educate them.

This reference (the lost-half) is made to the individual qualified to go to college—but doesn't. We must find ways to give higher education to all young people who could profit by it.

In particular we should encourage the gifted individual to continue toward the highest degree obtainable in his field, usually the doctorate. Considering that only one gifted person at the genius level out of five attains a doctorate degree, it is apparent that we are a long way off from a complete utilization of our resources.

Educators are preparing for the tremendous challenge of the future and the trends that are becoming more and more apparent. They are seeking new ways to educate our young talented people and also to reeducate experienced military, industrial and university personnel who are capable of absorbing additional education. This is most difficult since the amount of information in the world doubles every four years and as a result even the experts have difficulties in keeping up with their fields.

The Air Force has located a good percentage of its "lost-half." Recently a vigorous program has been established to train experienced officers for science and engineering careers within the service. In 1957 there were more than 400 officers who received graduate training in science and engineering that year. The number will increase to 1000 per year during 1961 and the annual figure will probably double by 1965.

Air Force Program

The present Air Force plan is to educate all officers who are educable as well as to train enlisted men who are trainable. The Air Force officers of the future will be heavily oriented toward science and engineering as evidenced by this one example. A B-52 Wing requires 136 technically trained officers. In contrast an Atlas Missile Wing requires 712 technically trained officers versus the B-52's 136.

Finally, the problems of numerical strength and quality of our scientists and engineers will be solved by a close coupling among the military, the scientist and engineer and the educator. We will know that we have taken our first big step toward an eventual solution of the scientist and engineering weapon shortage problem only when teaching is a well paid and highly respected profession.

Non-Profit Corp.

(*Continued from page 14*)

thority with respect to such use, but should be authorized on a term basis in keeping with current radio licensing practices.

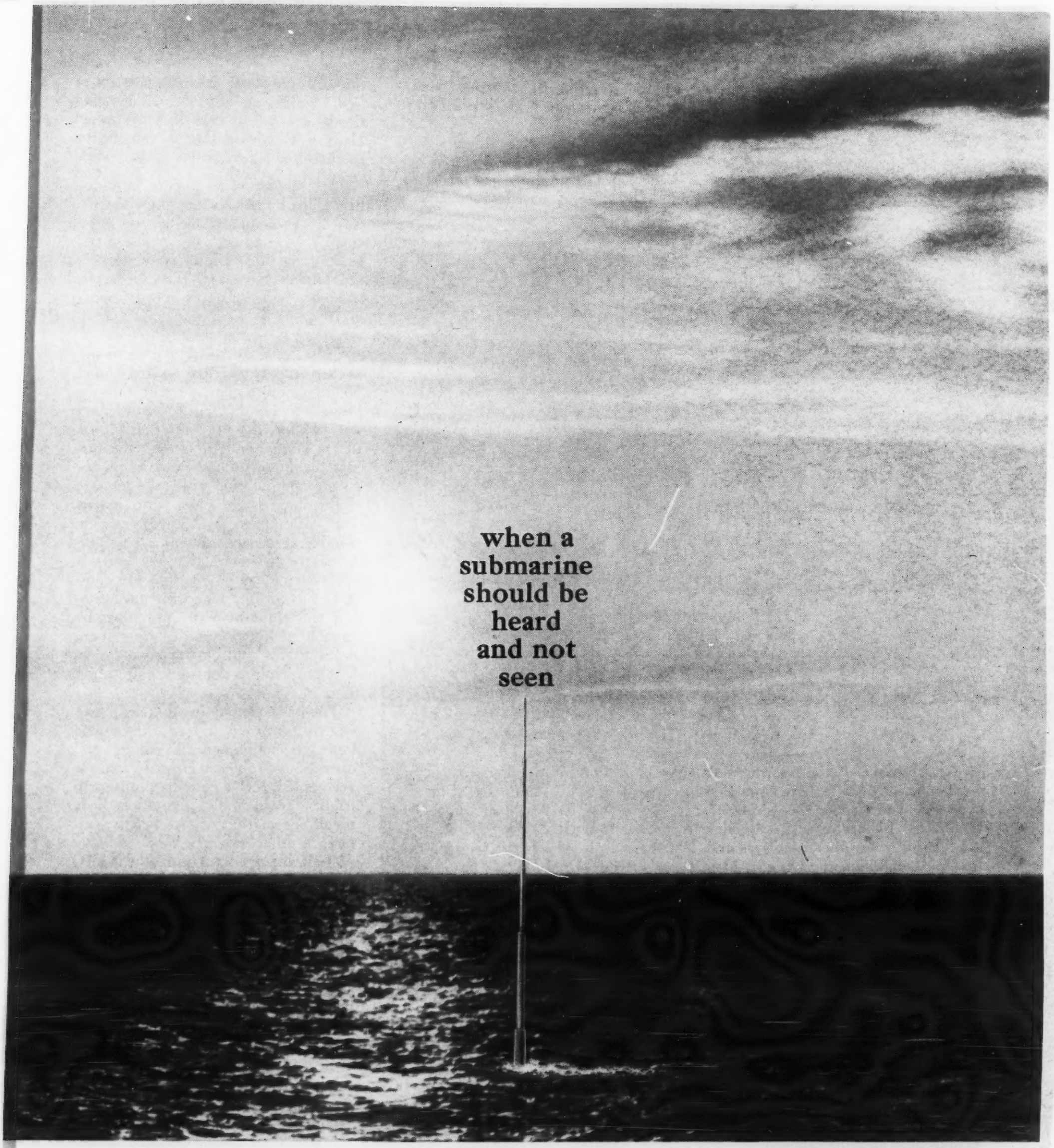
5. To the extent that applications to use capacity in the satellites exceed the available capacity, the Commission would determine which applications, including those for renewal of authority, should be granted in whole or in part on a comparative basis in accordance with usual procedures under the Communications Act.

6. Carriers which are authorized to use capacity in excess of their proportionate ownership interests, if any, would pay reasonable rent to the owning carriers on an actual cost basis, including return on investment, in accordance with approved rate-making principles.

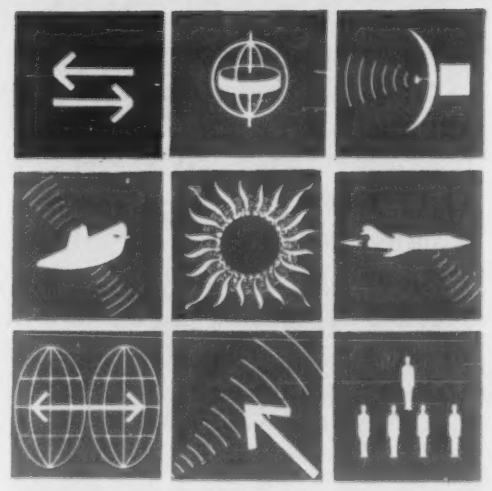
7. The satellite corporation would act as a clearing house for adjusting differences between ownership and use and arrange for the resulting payments between the carriers in accordance with the principles herein set forth and subject to the Commission's authority to determine need and use of the facilities and to prescribe just and reasonable charges."

In discussing the state-of-the-art of communications satellites, the report notes that further research and development will be needed before a fully operational commercial communications satellite network can be established. Techniques which are being considered for such a network are medium altitude and high altitude systems. Both systems would use active repeater satellites in orbit to receive, amplify and retransmit radio signals in a manner similar to present overland microwave relay repeaters. The committee believes that it might be possible to have a system utilizing medium and/or high altitude satellites in operation by 1965. However, the system will not be operational by 1965 unless a communications satellite organization is established promptly, and international agreements on frequency allocations and other matters are completed as soon as possible.

Now that the report has been submitted to the FCC, the next step will be for the Commission to act upon the committee's recommendations. If the Commission approves the form of the communications satellite corporation as set forth in the report, the authorized international common carrier companies will take steps to establish the corporation.



The AN/WRA-2 Antenna is the most efficient h-f antenna yet developed for submarine use. It is part of a complete communications system designed and manufactured by Hoffman for use on our Navy's nuclear-powered submarines. Fully retractable and built to withstand sea-pounding punishment, this Hoffman antenna is also adaptable for surface vessels and hard base missile sites.



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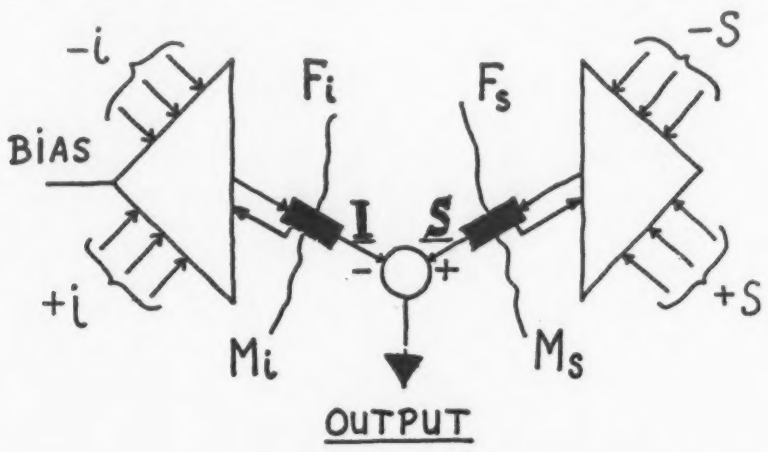
Bionics

(*Continued from page 22*)

"Moving Target Indicators" of today's radars urgently need refinement in automatic target identification, categorization and "primary interest" selection.



i AND S = PRIMARY AND SECONDARY INPUTS
M_i AND M_S = MODIFYING INPUTS
F_i AND F_S = FIX - FORGET INPUTS
I AND S = INTERNAL STATE FACTORS

Component Model

Figure 1.

The most significant effort to date has been in the area of the neuron or basic brain cell. Dr. Steele's analysis of the functions of the neuron were translated into mathematical models by mathematicians of the Electronic Technology Laboratory. These models are the basis for the prototype artifical neuron which the General Electric Company at Syracuse, New York has produced. (5) This neuron does not duplicate Dr. Rosenblatt's Perceptron at Cornell University or the Artron by Melpar. A signal picked up by any type sensor or from another neuron will be fed to a g-unit consisting of a combined electro-luminescent-photo-conductive cell and transfluxer or magnetic integrating memory element. A combination of units will be known as a g-set and designated by the number of inputs. One g-set (units designated g_1) is necessary for signals coming from other logic levels and a second g-set (units designated g_s) is required for signals from the same logic levels. Added to these are automatic bias adjustments (+ or — multiply) with fix-forget circuitry (F), feed-back loop to provide a weight factor, an output expander (M) and an output comparator (Difference Amplifier). The combination of all of these components will constitute a single neuron of specified input-output capacity. The relationship of signals within the complete General Electric neuron is shown in Figure 1 below.

The intricacies of a single device are compounded exponentially as networks of neurons are formed to accomplish useful functions. The molecular electronics concept is one of the tools which will help to reduce the obvious complex structure to manageable proportions.

Our immediate short-range program will have self-orientation and inter-disciplinary coordination as a continuing effort while working specifically on sub-systems and network theories. Two of the Engineering Bionics tasks scheduled for FY-61 are titled: "Mathematical and Physical Analysis and Modeling of Electronic Systems and Sub-Systems Based on Bionic Data," and "Bionic Sub-System Techniques" and they will be funded with approximately half a million dollars. Eight Purchase Requests were issued under these tasks and contracts have been awarded as follows:

1. Investigation of Image Analysis Techniques—Radio Corporation of America
2. Dynamic Self-Organizing Pattern Recognition Model—Laboratory for Electronics, Inc.
3. Bionic Component and Network Simulation—International Business Machines Corp.
4. Bionics Component Development—General Electric Co.
5. Neural Net Synthesis—Massachusetts Institute of Technology.
6. Generalized Machine Learning —Melpar, Inc.
7. Electronic Realization of Functional Nerve Nets—Melpar, Inc.
8. Simulation of the Biological Clock (6) — University of Arizona Medical Bionics tasks are similarly funded for FY-61.

This modest beginning is in addition to the numerous tasks now underway in the computer techniques area since the computer stores and processes data in a manner analogous to the human memory. The brain is capable of a memory of approximately 10^{20} bits as compared to our best rapid access computer memories of 10^6 bits; and the number of neurons packed into an average head is about 10^6 times more compact than today's best microminiaturized computer. (7) So far, the only real advantage that a computer enjoys over the human brain is quicker and more accurate computation ability!

Our long-range plan is to orient our techniques and hardware for reliable aerospace systems. It will be necessary to insure that the various sub-systems are compatible for complete flexibility. Our ultimate learning and thinking machines must be capable of functioning in any system, be it flight control, reconnaissance, communications or a combination thereof.

The price we pay for this flexibility will be returned to use in reduced logistics, maintenance, training and operations problems. How this will be accomplished is a complete subject in itself. Incidentally, there has been much speculation on the progress. if any, in other nations. Work is being done in many countries of the NATO complex in much the same manner as was performed previously in the United States, that is, on a piecemeal basis. Rumor has it that the Russians are making an all-out effort to capitalize on the Bionics concept. I say rumor because specific efforts, which have been reported, could not be satisfactorily verified. The Russians do not use the title "Bionics" and I am sure they do not use the word "capitalize" in describing their efforts. The Institute of Automatics and Telemechanics of the Academy of Sciences of the USSR has been working in cybernetics for some time and we have access to all of their published papers.

Several notes of caution must be sounded before I close. R&D in the field of Bionics will not be accomplished by organizations awarded government contracts based solely upon their reputations. The multitudinous facets of this new science dictates that a great deal of the basic research be pursued privately. This, in turn, will indicate which organizations have the

capability and the potential to develop components and systems oriented towards the solutions of our aerospace problems. Quantities of Ph.D.'s and oodles of square feet of laboratory floor space will not be, as influential with the Contracting Officer as will actual working results.

I must also warn that Bionics will not do everything! Our emphasis has been on the *electronic* simulation of living functions. It is possible and highly probable that other engineering disciplines may simulate certain functions more simply than can any electronic analog. We invite these disciplines to join forces with us towards the common goal of functional efficiency.

And finally, I am positive that you will agree with me that certain human functions should be reserved exclusively for the human. We can accept the idea of producing machines by humans but the reverse is definitely not one of our goals at this time.

For those individuals who have expressed concern that machines will eventually replace men, I recommend an anti-bionic in the form of the famous F.D.R. bromide, namely that, "The only thing we have to fear is fear itself." These people must be reminded that scientists who have come so far as to design these machines have not been standing still mentally. There is every reason to believe that they will continue to exercise their intellectual potential at an ever increasing rate so as to remain ahead of their own creations.

I have shown you some examples of the need for automation in military aerospace operations. Accelerated requirements have prompted us to dissect the general subject of Bionics into manageable, understandable disciplines more easily identifiable with today's terms of reference. With additional knowledge will come new perspectives and a reorientation of our approaches.

The work we are embarking on today in Bionics will lead us to our goal for tomorrow—reliable aerospace systems.

This short preview of Bionics, why we need it and how we expect to achieve our aims has been a "once-over lightly" treatment. It was designed to arouse your curiosity and, hopefully, your enthusiasm to combine your resources with those of the USAF in a mutual attack on tomorrow's aerospace problems.

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(1) Preliminary Progress Report #AF-59 "Design and Operation of Digital Calculating Machinery," Harvard University, Cambridge, Massachusetts, Feb. 1960.

(2) Bernhard Hassenstein—"Uber die Wahrnehmung der bewegung von figuren und unregelmässigne helligkitesmustern"—Zeitschrift fur vergleichende physiologic Bd 40, S.556-592 (1958).

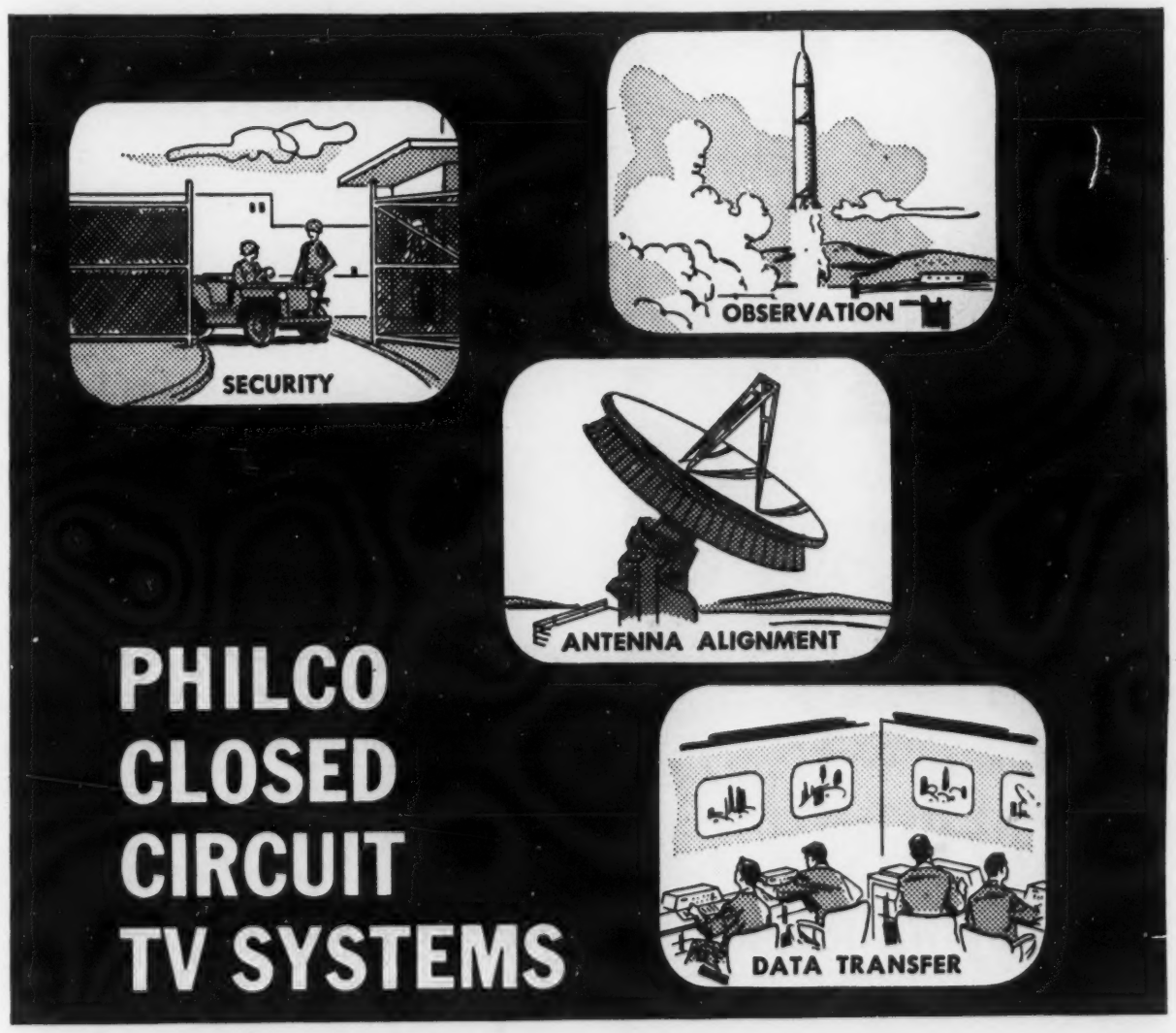
(3) Newell, Simon & Shaw (Rand Corporation) "A Variety of Intelligent Learning in a General Problem Solver" *Proceedings of an Interdisciplinary Conference* 5-6 May 1959.

(4) Lettvin, J. Y., Maturana, H. R., McCulloch, W. S., Pitts, W. H., "What the Frog's Eye Tells the Frog's Brain" *Proceedings of the IRE,* Vol. 47, No. 11, November 1959, pp. 1856-1862.

(5) Neuron Component Development. G.E. Electronics Laboratory, Computer Dept. Final Report, Contract No. AF 33(616)-6805. ARPA Order No. 73-59, Task No. 5—T. E. Bray, H. F. Windsor, G. Feidenbergs.

(6) "Life's Mysterious Clocks" by Frank A. Brown, Jr. — Morrison Professor of Biology at Northwestern Univ. P-18 *The Saturday Evening Post,* 24 December 1960.

(7) Dr. Leonard Sheingold, Chief Scientist, USAF and formerly Director, Applied Research Laboratory, Sylvania Electronic Systems "Research in Communications" paper to AFCEA, NY 1960.



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The Cape Canaveral Chapter of AFCEA will sponsor an industry-wide symposium to be held in the Cocoa Beach area March 6, 7, 8, 1962. The purpose of the symposium is to alert all those concerned with missile and rocket testing with problems (and possible solutions) associated with tomorrow's rockets.

We feel that a definite need exists to make maximum use of existing talent within military and private industry in developing new systems and techniques in support of future rocket testing. It is a well known fact that support requirements are often not known until the rocket has been developed and is ready for field testing. It is also a well known fact that initial tests of any program cannot be properly supported due to long lead times needed for development and procurement of required instrumentation.

The symposium is expected to acquaint manufacturers, missile contractors, military agencies and test ranges with anticipated problems and equipment desired in meeting test and safety needs. The problem areas for which papers will be requested are listed.

THEME: Test Problems of Tomorrow's Rockets

PURPOSE: To study the impact of future development of new vehicles on the problems of test support.

AREAS OF INTEREST:

1. Human Engineering: Can a man live in the environment created by some of the new engines? Define man's position in the future of vehicle design and operation.
2. Range Safety: What problems will be generated by the more powerful vehicles of the future? What steps must be taken to protect life and property? Define the range of the future and outline possible ground rules for safety activities.
3. Data Collection: What types of data will be required and what methods of collecting it may be used in the future?
4. Data Handling and Transmission: Is the trend toward "real-time" data and if so can this be done?
5. Test Facilities: What changes do you envision in present day test facilities to accommodate the vehicles of the future?
6. Communications: What requirements will be placed on the communicator and how can these requirements be met?
7. Test Range Development: What facilities and capabilities are foreseeable requirements on the test range of the future?
8. Frequency Control and Analysis: Suggest a solution to the interference problems in an already crowded spectrum.
9. Optics: What will be the role of optical instrumentation on the range of the future?
10. General: Any factors affecting test or range support, not considered part of the vehicle development.

SUGGESTED TYPES OF PAPERS:

1. Presentation of a Problem
   Problem areas are known to exist but have not, for various reasons, been brought out for general inspection and consideration.
2. Solution of a Problem
   Description of equipments, techniques or systems designed to solve an existing or anticipated problem.

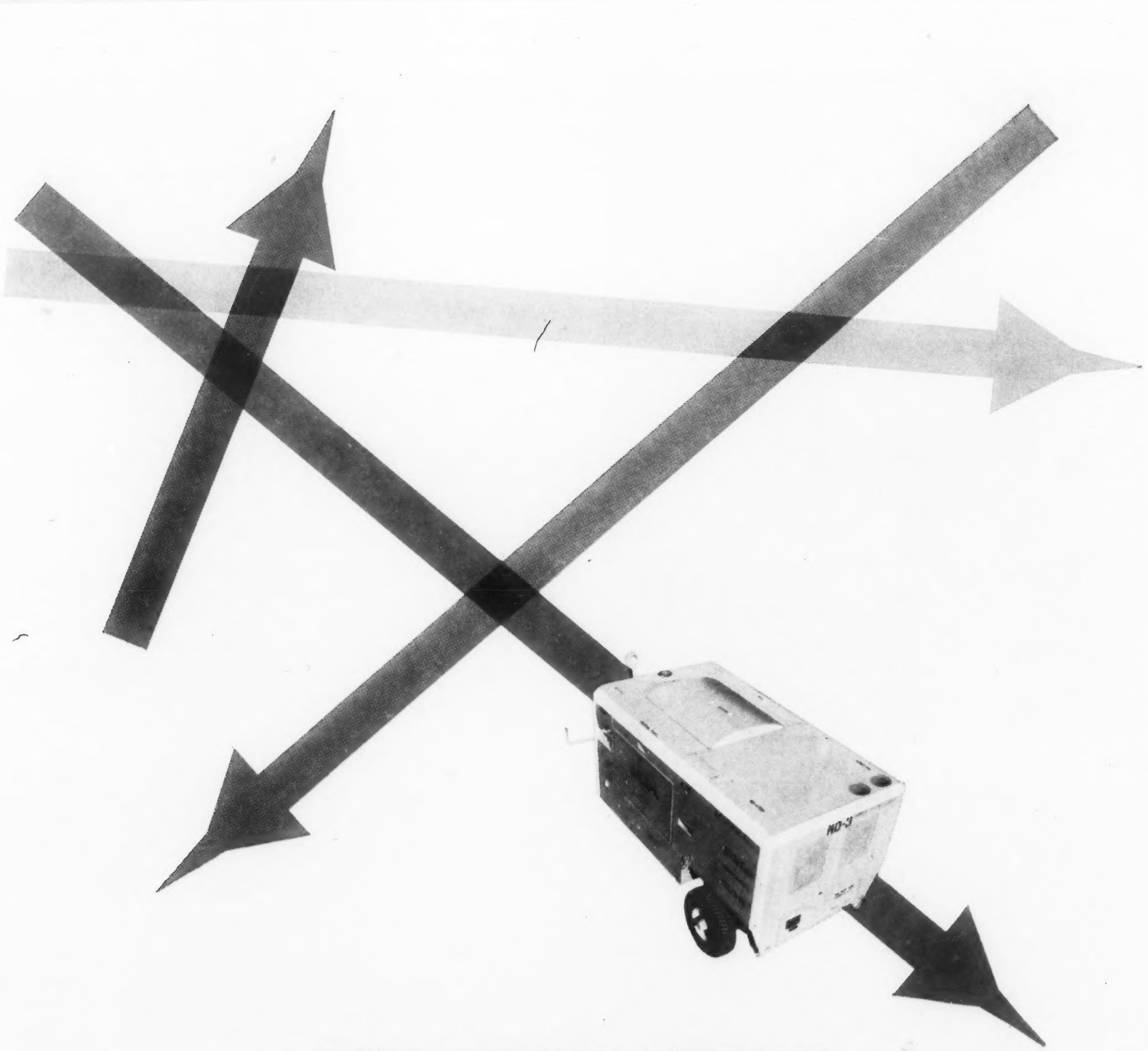
Abstract should be submitted to the listed address by 1 January 1962. Notification of acceptance will be made within 30 days. Two (2) copies of the complete paper, with 8" x 10" glossy prints of all illustrations will be required by 1 February 1962. Biographical data and a photograph of the author (s) is also requested. Biography should accompany the Abstract, photo with complete paper.

Papers should be unclassified and planned for a thirty minute presentation, with maximum time allowable forty-five minutes.

All those desiring to present papers on any of the above or associated subjects, should present a brief abstract of the paper outlining the major points to be developed (not over 500 words) to:

Chairman: Papers Committee
AFCEA
117 Atlantic Blvd.
Eau Gallie, Fla.
Attention: Mr. George L. Meredith

Roy Totty
Symposium Chairman



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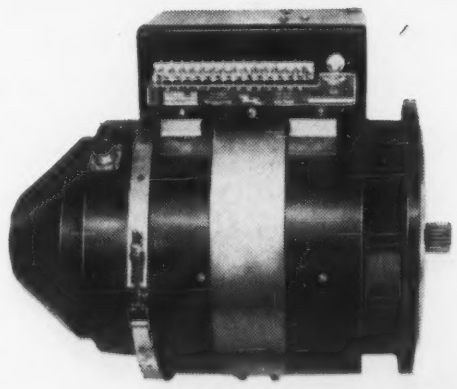

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Commander
Cruiser-Destroyer Force
Pacific Fleet

A *TRIBUTE*

FOR THE PAST FIVE YEARS, AFCEA has been very fortunate in having Rear Admiral Frank Virden, USN, as one of its National Officers and a member of its Executive Committee. Until recently, Admiral Virden served as Assistant Chief of Naval Operations (Communications)/Director, Naval Communications and established himself as one of the foremost leaders in the field of Naval Communications and Electronics. His selection to command the Cruiser-Destroyer Force, U. S. Pacific Fleet was excellent and was based upon his outstanding ability and over-all competence.

As a Vice President of the Armed Forces Communications and Electronics Association, his contributions to the military-civilian team concept and to our progress and growth have been numerous. His willingness to participate in all activities of the Association has not gone unnoticed. His wisdom and knowledge, coupled with his executive leadership and broad view point always were a source of continuing satisfaction and assurance.

Today, the National Officers and Directors are joined by the entire membership of the Association in congratulating Admiral Virden on his new assignment; in commending him highly for his meritorious service to our country; and in expressing our deep and profound appreciation for his continuing interest and help in AFCEA affairs.

We wish him well in his new assignment and know that he will have a "Happy Ship."

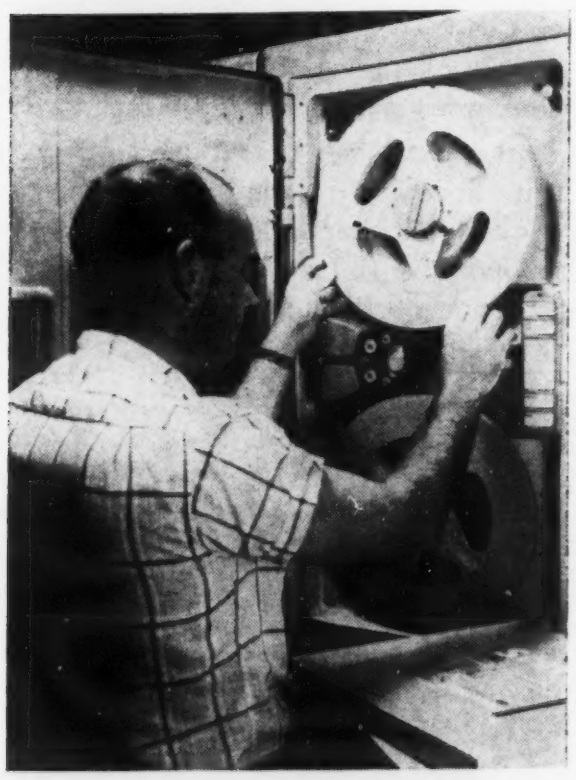
instrumentation magnetic tape for the Space Age

SIGNAL STAFF REPORT

MAGNETIC TAPE IS becoming increasingly more sophisticated to meet man's demands for meticulous running accounts—from launching to landing—of his first inquiring steps into space.

Tape used for the multi-million dollar tests is a far cry from the paper-backed product first introduced commercially 13 years ago by Minnesota Mining and Manufacturing Company. At that time the 3M Company announced magnetic tape principally as a boon for the home, business and school because of its sound reproducing ability.

Today, magnetic tape—useful in telemetry more for its electronic pulse recording than for its voice recording quality—is riding along with capsules fired in America's man-in-space program. The National Aeronautics and Space Administration relies upon instrumentation magnetic tape to capture every second of data even though communication is cut off between astronaut and ground station during the information-packed Project Mercury flights.



After transfer of tape from Mercury capsule recorder to standard reels, taped record is played back for post-flight analysis of data. Here a technician at Cape Canaveral loads standard tape transport with the tape of Commander Alan B. Shepard's May 5 flight.

As in any rocket launching, magnetic tape is used routinely for tracking the capsules by Cape Canaveral and down range telemetry stations; however, Mercury tests also feature a unique form of tape recording: a miniature recorder carried on board the capsule itself to obtain detailed information for post-flight analysis.

This is a reel-to-reel tape recorder designed by Consolidated Electrodynamics Corporation (CEC) to occupy as little as possible of the limited space in the capsule. Measuring only 11 by 13 by 3⅝ inches, complete with electronics, the recorder weighs only 12 pounds, fully loaded with tape, and operates at 1⅞ ips, recording a maximum of 3 kc.

Flight Account

To assist in assuring that a record is made of what occurs, the device records essentially the same data as the telemetry ground stations. The on-board recording, however, is an unbroken running account of the flight, while the ground recording can lose part of the signal as the craft goes through the ionization blackout stage, according to NASA telemetry experts.

No RF (radio frequency) is involved in the on-board recording. One channel of voice communication from the astronaut and up to six channels of multiplexed analog data from appropriate record amplifiers are recorded. In addition to the astronaut's voice commentary and physiological phenomena—respiration, deep body temperature, and electrocardiogram—detected by sensitive pickups taped to his body, the on-board tape keeps a record of such environmental conditions as temperatures, pressures, acceleration and shock. On two separate tracks, pulse duration modulation records the sequence of events and performance of the spacecraft, such as pitch, roll and yaw.

This "Scotch" brand No. 499 tape has a long wearing coating designed to minimize oxide rub-off, reduce build-up of electrostatic charges, and resist high temperatures. This tape has been specified by CEC for use in the recorder to assure optimum performance. On a thin (.92 mil) poly-

The capsule recorder's two stacked 10½ inch reels hold 3,600 feet of a special "heavy duty" instrumentation tape developed by the 3M Company. ester backing, the ½-inch wide tape provides nearly 6½ hours of continuous recording.

Heavy duty oxide has 1,000 times greater conductivity than conventional tape thereby reducing static charge buildup, according to the manufacturer. Static buildup tends to attract dust and other foreign particles which can collect and show up as dropouts. It also can cause tape to "stick" as it travels through recording equipment and can result in flutter and wow. Heavy duty oxide does away with many of these problems by acting as a "static drain," according to company lab technicians.

When Project Mercury's chimpanzee-carrying capsule was launched January 31, 1961, unexpected thrust from the Redstone booster and the escape rocket of the abort system raised the launching missile's velocity to 5,000 mph—1,000 mph faster than anticipated. Reaction of the simian astronaut to the resultant forces was recorded in full on one of the CEC recorders. During the flight, and despite

the tremendous forces to which he was subjected, "Ham" hit a lever every 20 seconds and turned out a light every five seconds. His recorded reactions later were compared with those of a backup chimp identically instrumented on the ground. Other parameters recorded included cabin temperature and pressure, sequences, altitudes, rates, and biological data such as rectal temperature and heart activity.

By the time the capsule was fished out of the ocean two hours after launching, water had seeped in and submerged the recorder, resulting in a dramatic test of the tape's heavy duty binder. Despite having been subjected to excessive acceleration pressures and prolonged soaking in corrosive salt sea water, the tape retained its construction and played back with full fidelity providing the only continuous record of the flight—from two minutes before take-off to touchdown.

Temperature and humidity conditions vary from one extreme to another in Mercury tests. A capsule conceivably could land in either equatorial waters or snow covered mountains, where it might remain for prolonged periods before being located, Mercury instrumentation engineers point out.

The tape also is subjected to extreme conditions during launching and re-entry. (Operational environment specifications listed for the on-board recorder by McDonnell Aircraft Corporation, prime contractor for the capsule, included a temperature range of —15 to 200°F., vibration ±10 g from 5 to 2,000 cps, continuous acceleration to 6 g's along all axes, and shock to high g).

In addition to the ambient temperatures involved during the flight, heat results from friction at the recording head when the tape is played back for post-flight analysis on high speed and high tension data processing equipment. Although the tape mass and tape speed tend to reduce the effects of this heat by limiting it to a few micro-inches of penetration, this penetration is enough to break down the binder system of low temperature oxide, resulting in oxide rub-off which can be the source of dropouts after the initial pass.

Heavy duty tapes have been exposed to temperatures ranging from —40 to 250°F. without showing binder deterioration; within these temperature limits, the tapes will not cap or show layer-to-layer adhesion, according to the manufacturer.

To date, eight Mercury capsules have been launched. CEC recorders were installed in seven, five of which were recovered. Capsule No. 3 was destroyed on impact because of a rocket malfunction and No. 8 sank to the ocean floor after unsuccessful attempts to retrieve it by helicopter. Commander Virgil Grissom made the United States second sub-orbital flight in this capsule on July 21, 1961. Recorders in the five recovered capsules were found to be in excellent condition, with taped records intact.

The on-board tape recording obtained during Commander Alan B. Shepard's historic sub-orbital trip May 5, 1961, contained every phase of the flight, from start to finish, according to W. T. Sleeman, Project Mercury Aerospace Technologist for Electronic Flight and Support Equipment. Real time telemetry also was received at eight different stations covering the various functions. However, Shepard's voice came through much clearer on the on-board tape than on the ground stations' tapes, Sleeman reported.

Tapes produced by the capsule recorder are played back on a standard reproducer using a special adapter supplied with the recorder for matching the hubs to standard reel hubs.

19 SPACE-SAVING REPEATER PLUG-INS IN THIS CAN!

(typical plug-in, shown actual size)

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450B	AMPLIFIER, REPEATER
453B	AMPLIFIER, REPEATER
455B	AMPLIFIER, REPEATER
457B	AMPLIFIER, REPEATER
460A	AMPLIFIER, COMPRESSOR
461A	AMPLIFIER, POWER
12912	EQUALIZER
13530A	COMPROMISE NETWORK
13531	NETWORK H88
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13533A	NETWORK
13594	RELAY ASSEMBLY
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THE ITU AND SPACE COMMUNICATIONS

by

GERALD C. GROSS
Secretary-General
International Telecommunication Union

THE HISTORY OF THE International Telecommunication Union (ITU) in the field of international cooperation has been impressive. In its very specialized technical field, there has been remarkable cooperation among all nations involving all forms of political opinion. The successful results achieved and maintained over a period of almost a century provide a very concrete example of what can be done among scientists and engineers.

The International Astronautical Federation, (IAF) under the distinguished leadership of the existing President, Professor Leonid I. Sedov of the Russian Academy of Sciences in Moscow and the General Counsel, Andrew Gallagher Haley of the United States, has demonstrated in a brilliant way that such active cooperation for the peaceful development of astronautics is possible in the over-all interests of mankind.

In 1959 a technically modest, but landmark achievement in the affairs of mankind occurred in the City of Geneva. The *first* international rules of law applicable specifically to activities in outer space were negotiated by the International Telecommunication Union when provisions for frequency allocations involving newly-designated space radiocommunication services were inserted in a revision to the ITU Radio Regulations.

There is now scheduled an International Conference, probably to be held in 1963, and preceded by a meeting of a special International Radio Consultative Committee study group in the Spring of 1962 to consider the allocation of frequencies for space communication and other space purposes. Many of the countries who will attend these meetings and who will have a considerable influence on the ultimate results obtained, will not have an immediate requirement for the substantial allocation of frequencies for their own space activities. They will, however, have a principal interest in accommodating space needs on a basis that will not prevent the use of the same frequencies for more ordinary ground or earth microwave purposes. Many of them will be concerned lest the large countries, such as the United States and the Soviet Union, use the lower microwave frequencies in a way that may cause significant interference to their own ground services.

I have heard it suggested that it may be necessary to devise a procedure internationally for the review of actual frequency selection in order to assure the contemplated protection to many countries. And it has also been suggested that the ITU would be the appropriate place for such a function. Whether this need should be met by the ITU, must, of course, depend upon the policy decisions of the ITU government members.

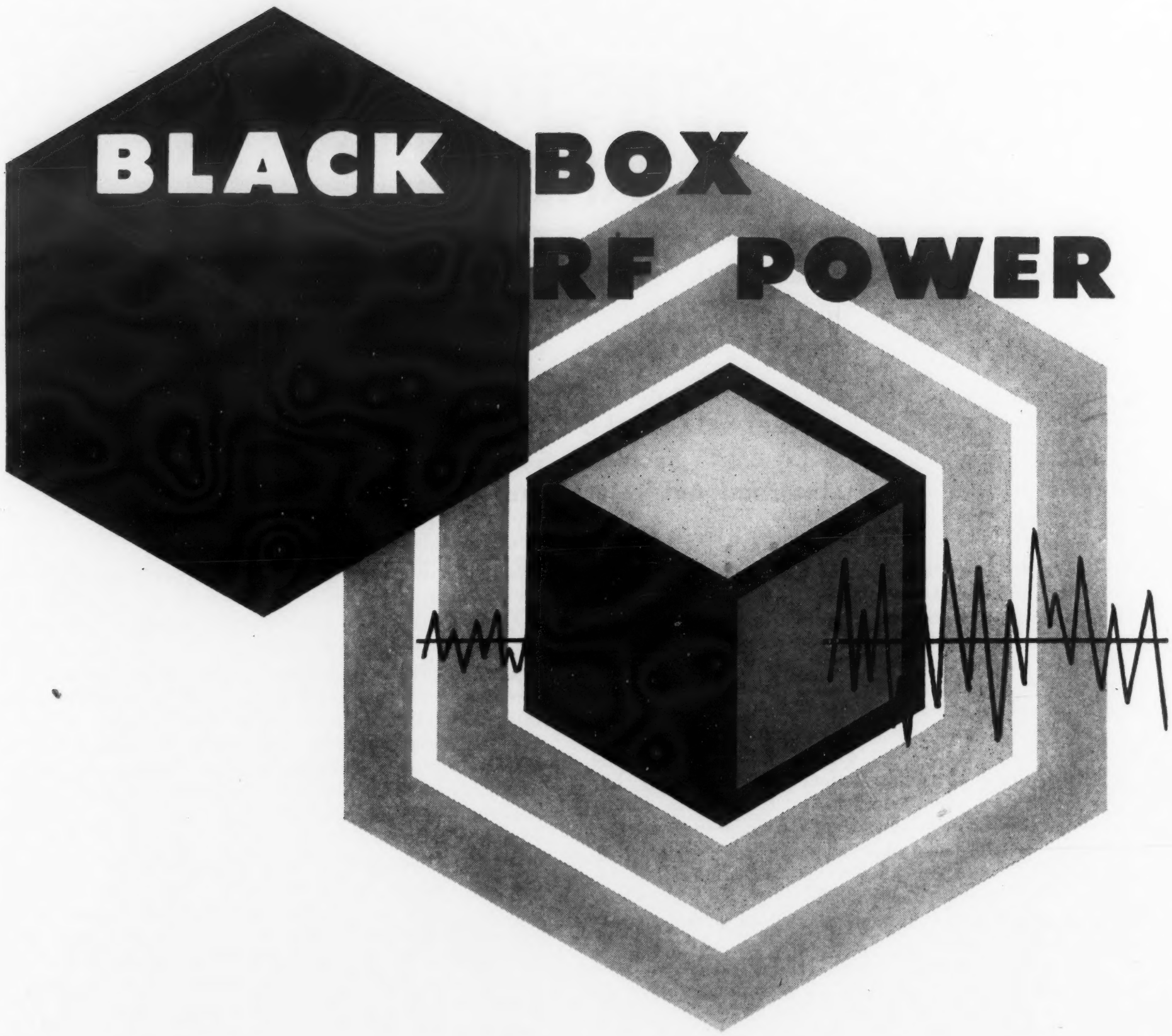
Let me give you another illustration of the kind of speculation that has come to my attention concerning the future role of the ITU in connection with space activities. The successful launching of a communications satellite system to provide extensive facilities throughout the globe inevitably involves a considerable amount of international negotiation. This will extend into areas far removed from technical frequency matters. It may well be that any system that is evolved will have participating ownership of a number of countries.

There must also be detailed operating arrangements and other agreements essential to the effective success of the venture. Much of the negotiations will be of a bilateral or multilateral nature between operating entities. Much of it will also involve broad basic political agreement between the interested countries. And these in turn will have a direct bearing upon the frequency allocations and technical standards that may be required. I have heard it suggested that these negotiations be within the framework of the ITU because of the long-standing experience of the ITU in the field of communications and its record of substantial success as an international agency.

Certainly the experience of the ITU in providing for international meeting and negotiation would come in handy in connection with matters such as I have just discussed. Again, whether the ITU should provide the framework within which such negotiation concerning communications matters is engendered must depend upon the careful judgment of the member governments.

Not an Operating Agency

Whenever one hears of space communication and the ITU, the question seems to arise whether the ITU should actually become an operating agency for the purpose of providing a communications satellite system accessible to the world. It cannot now become an operating agency. I use the term "operating agency" in the sense technically understood as an agency which itself operates a telecommunication service. In these terms let me say at once that ITU is *not* prepared at this time to go into the operating business of such a multi-million dollar network. It would take months and months, going into years to



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change the regulatory technical character of the ITU to fulfill such functions. Similarly, any new organization which might be created to act as an operating agency would in my opinion require much more time than is available to acquire the necessary know-how and competence.

I feel that we should at this time utilize the existing operating entities in the ITU member governments to meet the urgencies of the situation with due attention being given to the necessary technical and operating regulations in order to protect the ultimate communication services for the public. Specifically, such regulation should comply with the basic doctrine laid down in Article 4 of the International Telecommunication Union.

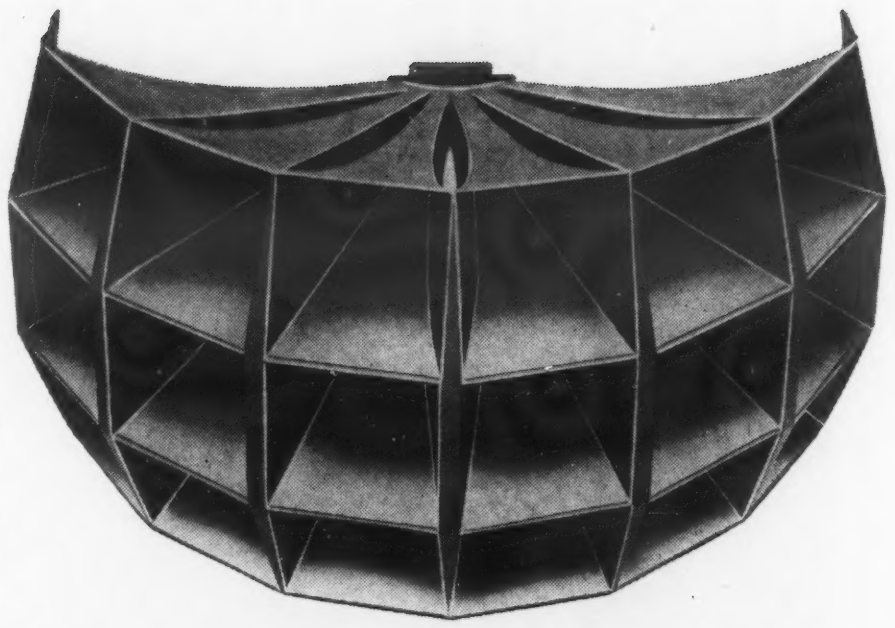
ARTICLE 4

Purposes of the Union

1. The purposes of the Union are:
   . . . b) to promote the development of technical facilities and their most efficient operation with a view to improving the efficiency of telecommunication services, increasing their usefulness and making them, so far as possible, generally available to the public;
   c) to harmonize the actions of nations in the attainment of those common ends.
2. To this end, the Union shall in particular:
   a) effect allocation of the radio frequency spectrum and registration of radio frequency assignments in order to avoid harmful interference between radio stations of different countries;
   b) coordinate efforts to eliminate harmful interference between radio stations of different countries and to improve the use made of the radio frequency spectrum;
   c) foster collaboration among its Members and Associate Members with a view to the establishment of rates at levels as low as possible consistent with an efficient service and taking into account the necessity for maintaining independent financial administration of telecommunication on a sound basis;
   d) foster the creation, development and improvement of telecommunication equipment and networks in new or developing countries by every means at its disposal, especially its participation in the appropriate programmes of the United Nations; . . .

I have spoken about the successful cooperation which it has been our good fortune to obtain in the ITU among all our member governments. As a further step in this direction I have invited the United States Government and the Soviet Government to send experts to Geneva to work with the ITU in the preparation for the 1963 World Conference on space communications. While the negotiations have been conducted so far with only the two governments mentioned—since they are the only two countries with active space satellites now operating—personnel from other member countries of the ITU would, of course, be most welcome. We need all the help we can get in this planning stage to assist in defining and delineating the many problems ahead of us.

The function of the ITU as a forum for countries of the world to resolve their basic problems with respect to telecommunication questions is obvious. Many coordinating problems inevitably will accompany such new types of operations in space. There will be related areas such as the possible negotiations to which I referred. These will be the areas in which attention should be given at this time, as a practical matter, in thinking about the role of the ITU.



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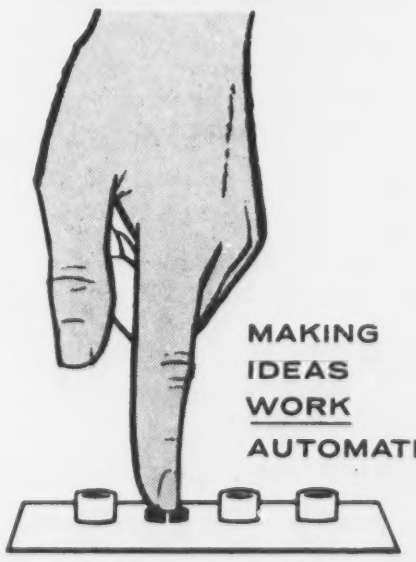

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NORTHWEST FLORIDA: Pres.—Col. S. K. Briggs, 708 Oseqola Cir., Eglin AFB, Fla. Sec.—Maj. W. E. Shine, 505 Gaffney Rd., Eglin AFB, Fla.

ORANGE: Acting Pres.—Vincent Meder, 744 S. Hampton, Orlando, Fla.

PENSACOLA: Pres.—Lt. Cmdr. H. M. Young, 4216 Acacia Dr., Pensacola, Fla. Sec.—D. E. Hansen, 208 Emerald Ave., Pensacola.

REDSTONE-TENNESSEE VALLEY: Pres.—Col. George E. Pickett, Sig. Officer, Hqs. USA Ordnance Missile Command, Redstone Arsenal, Ala. Sec.—Lt. Col. Henry B. Holmes, III, AOMC Sig. Office, Redstone Arsenal, Ala.

SOUTH CAROLINA: Pres.—H. L. Lackey, Southern Bell Tel. & Tel. Co., Columbia, S. C. Sec.—K. Hora, Southern Bell T&T Co., Owen Bldg., Columbia, S. C.

REGION D

Regional Vice President—Maj. Gen. Harry Reichelderfer, USA (Ret.), Southwest Research Institute, 8500 Culebra Rd., San Antonio, Tex. ***New Mexico, Texas, Oklahoma, Arkansas.***

LAWTON-FORT SILL: Pres.—Lt. Col. L. W. Ash, 1303 W. Upton Rd., Fort Sill, Okla. Sec.—Lynn Russell, 1805 Dearborn, Lawton, Okla.

NORTH TEXAS: Pres.—R. T. Shiels, Anaconda Wire & Cable Co., 1201 Fidelity Union Life Bldg., Dallas 1. Sec.—Robert J. Novak, AT&T Co., 212 No. St. Paul St., Dallas.

SOUTH TEXAS: Pres.—Col. A. Burke, Hqs., 4th U. S. Army, Ft. Sam Houston, Texas. Sec.—W. Gillum, (same address).

TINKER-OKLAHOMA CITY: Pres.—W. J. Cook, P. O. Box 5766, Midwest City, Okla. Sec.—R. E. Davis.

WHITE SANDS MISSILE RANGE: Pres.—S. D. Cozby, 704 Sugeant St., White Sands, N. M. Sec.—C. E. O'Meara, 1400 S. Luna, Las Cruces, N. M.

REGION E

Regional Vice President—Walter H. Pagenkopf, Teletype Corp., 5555 Touhy Ave., Skokie, Ill. ***Michigan, Indiana, Illinois, Wisconsin, Minnesota, Iowa, Missouri, Kansas, Nebraska, North Dakota, South Dakota, Wyoming, Colorado.***

CHICAGO: Pres.—Walter H. Flinn, Illinois Bell Tel. Co., 212 W. Washington St., Rm. 1601, Chicago 6, Ill. Sec.—Sanford Levey, 1303 Lincoln Ave. So., Highland Park, Ill.

DECATUR: Pres.—Capt. J. J. Lacey, 53 Whippoorwill Dr., Decatur, Ill. Sec.—H. E. Malone, 3814 Arthur Ct., Decatur, Ill.

GREATER DETROIT: Pres.—Col. J. I. Vanderhoof, 1921 Brock Court, Ann Arbor, Mich. Sec.—J. R. Saxton, Michigan Bell Telephone Co., 1109 Washington Blvd. Bldg., Detroit.

KANSAS CITY: Pres.—Lt. Col. H. Young, Jr., 29th AD Hq., Richards-Gebaur AFB, Mo. Sec.—W. B. Foulis, Jr., AT&T Co., Rm. 870, 811 Main St., Kansas City, Mo.

ROCKY MOUNTAIN: Pres.—W. R. Young, Asst. Govt. Mgr., AT&T Co., Tejon & Pikes Peak Ave., Colorado Springs, Colo. Sec.—A. D. Miller, Mt. States Tel. & Tel Co., 2542 E. Bijou, Colorado Sprgs., Colo.

SCOTT-ST. LOUIS: Pres.—Col. C. W. Evans, USA (Ret.), Southwestern Bell Telephone Co., 1010 Pine St., Rm. 827, St. Louis 1, Mo. Sec.—A. L. Eisenmayer, P.O. Box 456, Trenton, Ill.

REGION F

Regional Vice President—Lt. Cdr. Ray E. Meyers, USN (Ret.), Consultant, 717 Anderson Way, San Gabriel, Calif. ***Arizona, Utah, Nevada, California, Idaho, Oregon, Montana and Washington.***

ARIZONA: Pres.—Lt. Col. James W. Tuma, 161-B Grierson Ave., Fort Huachuca, Ariz. Sec.—Franklin K. Glasier, 105-B Hines Rd., Fort Huachuca, Ariz.

GREATER LOS ANGELES: Pres.—John W. Atwood, Hughes Aircraft Co., Culver City, Calif. Sec.—Joseph H. Goodrich, Pacific Tel. & Tel. Co., 737 S. Flower St., Los Angeles 17, Calif.

SACRAMENTO: Pres.—R. C. Berner, Pacific Tel. & Tel. Co., 4501 Arden Way, Sacramento 25, Calif. Sec.—Miss Ethel Klusman, 4925 Marconi Ave., Carmichael, Calif.

SAN DIEGO: Pres.—Capt. B. L. Bailey, USN, Cmd. Off. Miramar Naval Air Station, Miramar 45, Calif. Sec.—J. C. Orthel, 5483 Redding Rd., San Diego 15, Calif.

SAN FRANCISCO: Pres.—Col. H. L. Davis, Jr., 331 Infantry Terrace, Presidio of San Francisco, Calif. Sec.—H. W. Weddell, Rm. 117, Bldg. 35, Presidio of San Francisco, Calif.

SANTA BARBARA: Pres.—RAdm. Clarence C. Ray, 63 Manzanita Lane, Star Route, Santa Barbara, Cal. Acting Sec.—E. E. Foley, P.O. Box 636, Santa Barbara, Calif.

SEATTLE: Pres.—RAdm. H. H. McCarley, USN, 436 168th St., S.E., Bellevue, Wash. Sec.—Cdr. W. L. Bushy, USN, Hqs. U. S. European Cmd., APO 128, N. Y., N. Y.

EUROPEAN REGION

Regional Vice President—Brig. Gen. Kenneth F. Zitzman, USA (Ret.), International Standard Engineering, Inc., 40 Rue de Sevres, Boulogne Billancourt Seine, France.

FRANKFURT: Acting Pres.—Ralph L. Prokop, USA Procurement Center, APO 757, N. Y.

ITALIAN: Pres.—Capt. J. M. Grider, USN, CINC South, Box 9, FPO N. Y., N. Y. Sec.—B. Prezioso, 78 Via Lepanto, Naples.

LONDON: Pres.—Lt. Col. S. B. Hunt, USMC, Cincnelm, Box 91, FPO, N. Y., N. Y. Sec.—Lt. Col. J. C. Posey, HQ. 3d COMM. GP., APO 125, N. Y., N. Y.

PARIS: Pres.—RAdm. T. A. Torgerson, HQ. U.S. EUCOM C E, APO 123, N. Y., N. Y. Sec.—Cdr. W. L. Bushy, USN, Hqs. U.S. European Cmd., APO 128, N. Y., N. Y.

SWITZERLAND: Pres.—B. R. Dean, 13 Quai de L'ile, c/o RCA, Geneva, Sec.—Lt. Col. A. David, Royal Signal, British Army, U. N., Geneva.

PACIFIC REGION

Regional Vice President—Brig. Gen. Douglas Williams, USAF, Staff CINCPAC, APO 953, San Francisco, Calif.

HAWAII: Pres.—Col. W. A. Simpson, USA, Signal Office, Hq. USARPAC, APO 958, San Francisco, Calif. Sec.—Lt. Col. G. A. Kurkjian, USA (same address).

MARIANAS: Pres.—Capt. C. J. Alley, USN, U. S. Naval Comm. Sta., Navy 926, FPO, San Francisco, Calif. Sec.—Lt. Cmdr. W. Scott, USN, P. O. Box, FPO, San Francisco, Calif.

OKINAWA: Pres.—Lt. Col. L. P. Wynne, Cmdr. 1962nd AACS Squadron, APO 239, San Francisco. Sec.—E. N. Dotson, USCAR, APO 331, San Francisco.

PHILIPPINE: Pres.—Lt. Col. A. W. Hall, STARCOM, QTRS. 31 Clark, U. S. Acan Station, Philippines, APO 74, San Francisco, Calif. Sec.—J. C. Behrick (same address).

TOKYO: Pres.—Capt. W. H. Kreamer, USN, Staff COMNAVFOR, Japan, FPO, San Francisco, Calif. Sec.—Lt. W. E. Trelford, USN (same address).

CHAPTERS AT LARGE

ALASKA: Pres.—Col. H. L. Hughes, USAF, Hq. Alaskan Communications Region, APO 942, Seattle, Wash. Sec.—T. C. Harris, 2411 Karluk St., Anchorage, Alaska.

SAN JUAN: Pres.—W. Siddall, Radio Corporation of Puerto Rico, P. O. Box 3746, San Juan 18, P. R. Sec.—A. R. Crumley, Jr., Crumley Radio Corp., Box 10073, Caparra Heights, San Juan.

Chapter News

Atlanta—(Photo left) Shown at the September 13 meeting are (L. to R.) Capt. I. J. Schwartz, USN, chapter president; Brig. Gen. Lester S. Bork, USA, guest speaker, and J. C. Baughman, program committee chairman. **Lexington**—(Photo right) Shown at a recent meeting are (Standing L. to R.) A. A. Abraham, president, Radio Electronic Equipment Co.; F. C. Rahdert, Jr., president, General Telephone Co. of Kentucky; Col. J. W. Johnston, guest speaker; Col. C. H. Phipps, USA; Lt. Col. H. L. Morris, USA (Ret.), chapter president; and W. Neubauer. Seated is Prof. John Jackson, Univ. of Kentucky.

REGION A

Fort Monmouth

A dinner meeting was held October 19 at Gibbs Hall, Fort Monmouth, N. J. Dr. Constantine D. J. Generales, coordinator of Space Medicine Research at New York Medical College was guest speaker. Dr. Generales carried out experiments in space medicine research in collaboration with Dr. Werner Von-Braun as early as 1931.

Dr. Generales spoke on "Space Medicine Research." In his talk, he said, "Space science and space medicine appear to unite people and nations as strongly, if not more so, than any other heretofore organization."

Syracuse

A dinner meeting was held October 11 at the Sheraton-Syracuse Inn. Eighty-four members and their guests were present.

Dr. Warren Bartlett Walsh, professor of Russian history and chairman of the Board of Russian Studies at Syracuse University was guest speaker. Dr. Walsh was formerly associated with the National War College in Washington, and with the North Atlantic Treaty Organization in Europe.

In his talk, entitled "Does Khrushchev Mean It?" Dr. Walsh outlined the philosophy of Communism. A question and answer period was held after the talk.

J. G. Labedz was elected president to succeed Captain J. E. Thompson who has been transferred. S. L. Calderwood succeeds Mr. Labedz as Secretary.

REGION C

Atlanta

The first dinner meeting of the 1961-1962 season was held at the Fort McPherson Officers Open Mess. Two hundred members and guests were present.

Brigadier General Lester S. Bork, Commanding General, U. S. Armor and Artillery Firing Center, Fort Stewart, Georgia, was guest speaker.

In his illustrated talk entitled "Our Trouble Spots," General Bork briefly outlined the world situation in the struggle with Communism, and then focused his remarks on East and West positions in the Berlin crisis, and on Viet-Nam and Laos.

Newly installed officers are: president: Captain I. J. Schwartz, USN, Commander of the Naval Air Station-Atlanta; vice presidents: Captain Jesse Draper, USN (Ret.), Draper-Owens Company; Colonel Hoyt E. White, Third U. S. Army Executive Signal Officer; S. B. Wynne, Southern Bell Telephone & Telegraph Company; Robert C. Sawyer, Georgia Division of Lockheed Aircraft Corporation; secretary-treasurer: M. S. Butler, Southern Bell Telephone & Telegraph Company; corresponding secretary: Mrs. Wilma Minix, Headquarters Third U. S. Army.

Those elected to the Board of Directors are: Harvey J. Aderhold, WLWA-TV; Brigadier General W. W. Airing. USAF, 3rd AF Reserve Region, Dobbins AFB, Georgia; A. E. Arnold, Western Union Telegraph Company; R. J. Dellenback, The Snap Shop Photography; E. O. Betscher, American District Telegraph Company; Howard T. Davis, Graybar Electric Company; Ben S. Gilmer, president, Southern Bell Telephone & Telegraph Company; Charles S. Hardy, Southern Bell Telephone & Telegraph Company; Gerald H. Ghertner, Cullom & Ghertner Company; W. K. Mosley, Southern Bell Telephone & Telegraph Company; G. E. Mulliniks, Western Union Telegraph Company; George M. Olive, General Electric Company; John S. Seigle, vice president, Southern Bell Telephone & Telegraph Company; Colonel Robert B. Tomlinson, Third U. S. Army Signal Officer; A. W. Webber, Southern Bell Telephone & Telegraph Company; Hoyt A. Wiggins, Georgia Power Company; A. M. Wilson, Southern Bell Telephone & Telegraph Company.

Newly appointed committee chairmen are: constitution and by-laws: Sam J. Elliott, Western Electric Company; house committee: Lieutenant Colonel William Rogers, Third U. S. Army; membership committee: Robert B. Alford, Georgia Public Service Commission; program committee: J. C. Baughman, Southern Bell Telephone & Telegraph Company; publicity committee: Coleman Alford, Third U. S. Army; and reception committee: Victor O. Cain, Southern Bell Telephone & Telegraph Company.

Augusta-Fort Gordon

William S. Henry, district manager, Defense Systems Department, General Electric Company, was guest speaker at the September chapter dinner meeting.

Mr. Henry spoke on the relationship of technology to military strategy and tactics.

Cape Canaveral

Ladies night was held October 21 at the Missile Room of Patrick Air Force Base Officers Club. Lain Dubose, Pan American Airways employee of the Guided Missile Range Division, was guest speaker.

Gulf Coast

A dinner meeting was held October 2 at the Airman's Club, Keesler Air Force Base, Mississippi.

Richard A. Harrison of the International Business Machines Corporation,

Augusta-Fort Gordon—(Photo left) William S. Henry, Southeastern District Manager, General Electric's Defense Systems Dept., is pictured addressing chapter members at the September meeting. **Washington**—(Photo right) Shown at October 5 chapter meeting are (L. to R.) William Alvis, chapter president, Dr. Leonard Sheingold, Chief Scientist for the Air Force, and guest speaker at the meeting; Maj. Gen. John Bestic, USAF, Director of Telecommunications; and Maj. Robert P. Barnes, USAF. (See page 6 for Dr. Sheingold's complete address.)

Huntsville, Alabama, was guest speaker. Mr. Harrison's topic was "Advanced Computer Applications." He illustrated his talk with samples of circuit building blocks from electronic computers to show how miniaturization and sub-miniaturization are being achieved.

Middle Georgia

On October 10, a tour of the Georgia Power Company was conducted for the chapter members. Following the tour, a dinner meeting was held at the Pinebrook Inn Restaurant, Macon, Georgia.

Tom Shockley of the Georgia Power Company presented a program after dinner.

Following the program newly elected officers were installed. The new officers are: president: John Booth, Southern Bell Telephone and Telegraph Company; vice president: Major Robert Hill 4137th STRAT Wing, Robins Air Force Base, Georgia; vice president: Lieutenant Colonel E. Gibson, Continental Air Command, Robins Air Force Base; and secretary-treasurer: J. D. Walker, Southern Bell Telephone and Telegraph Company.

Northwest Florida

A buffet dinner meeting for 46 members and their wives and guests was held September 29 at the Officers Club, Eglin Air Force Base. A. Peterson of the Sperry Rand Corporation was guest speaker.

Mr. Peterson spoke on the over-all activities of Sperry Rand Corporation with special emphasis on the Mobile Atlantic Range Station (MARS) project. He used slides to illustrate his speech.

Following Mr. Peterson's talk, a film entitled "Split Second World" was shown. The subject of the film was FPS-35 Radar.

REGION D

Lawton-Fort Sill

A meeting was held September 28 at the Southwestern Bell Telephone Exchange. Mrs. Opal E. O. Blois presented a discussion on the proper use of the telephone system in use at Lawton and Fort Sill.

Charles M. Gale and Mr. Countryman, both of Southwestern Bell Telephone Company conducted a tour through the plant.

Dwain Redding of Southwestern Bell showed a machine which is named the Pea Picker. This machine is capable of checking all equipment and noting deficiencies located during check. The check takes 24 hours.

After the tour, a question and answer period was held.

REGION E

Chicago

Major General James F. Whisenand, USAF, DCS/Plans, Air Force Systems Command was guest speaker at a recent chapter meeting. General Whisenand spoke on "Military Man In Space."

In his talk, General Whisenand said that, ". . . the National interest demands that there be the closest possible integration of the military space program and the civilian-directed programs."

Greater Minnesota

An organizational meeting was held October 19, at the Minikadha Country Club, Minneapolis. About 40 men were present for the luncheon meeting.

W. L. Huffman, vice president and general manager of Northwestern Bell Telephone Company is acting president, and B. W. Northrup, Western Electric Company, Incorporated is acting secretary.

Walter H. Pagenkopf, Region E vice president, addressed the group. Mr. Pagenkopf presented a brief history of AFCEA and its official journal, SIGNAL. He also spoke of the National Convention.

A temporary membership committee was approved. Members of the committee are W. L. Huffman, vice president and general manager, Northwestern Bell Telephone Company; Major General F. H. Britton, USA; M. B. Bock, manager, M. B. Bock & Associates; E. J. Gaw, manager, Western Electric Company, Incorporated; H. E. Taylor, Jr., director of marketing, General Mills, Incorporated; and C. P. Pesek, vice president, Minnesota Mining & Manufacturing Company.

Rocky Mountain

The first meeting of the 1961-1962 season was held September 28 at the Ent Air Force Base Officers Open Mess. Ninety-four persons were present for the dinner meeting.

Newly elected officers for 1961-1962 are: president: W. R. Young, assistant government manager, American Telephone & Telegraph Company; vice president programs: Group Captain Robert E. Mooney, RCAF; vice president membership (Colorado Springs Area): Norman McBride, American Telephone & Telegraph Company; vice president membership (Denver Area): Bruce R. Smith, Mountain States Telephone & Telegraph Company; vice president publicity: Lieutenant Colonel Edward T. Pompea, USAF; treasurer: John W. Houmes, General Electric Company; secretary: Albert D. Miller, Mountain States Telephone & Telegraph Company.

Those elected to the Board of Directors are: Brigadier General David P. Gibbs, USA DCS/C-E NORAD; Colonel Robert T. Hosken, Director C&E Air Defense Command; Colonel Erling J. Foss USA Signal Officer, U. S. Army Air Defense Command; Captain Robert M. Bruning, U. S. Navy, J-5 NORAD; James F. Edwards, Mountain States Telephone & Telegraph Company; and Marion F. Sanders.

Scott-St. Louis

Seventy-five members and guests were present at the October 6 chapter meeting. Guest speaker was John F. Auwaerter, Director of Product Develop-

Arizona—(Photo left) Pictured at the September 22 meeting (L. to R.) are Lt. Col. Claud D. Handing, former chapter president; guest speaker, Dr. Daniel E. Noble, executive vice president of Motorola, Inc., and Lt. Col. James Tuma, chapter president. **Greater Los Angeles**—(Photo right) Pictured (L. to R.) at a recent meeting are John W. Atwood, chapter president; Cmdr. Karl Breneman, USNR, Commanding Officer of USN Public Relations Company 11-4, guest speaker of the evening, and Ray Meyers, chapter vice president and Region F vice president.

ment, Teletype Corporation, Chicago. Mr. Auwaerter spoke on "High Speed Weather Data Communications Systems."

REGION F

Arizona

Dr. Daniel E. Noble, executive vice president of Motorola, Incorporated was the guest speaker at the September meeting held at the Lakeside Officer's Club, U. S. Army Electronic Proving Ground, Fort Huachuca.

Greater Los Angeles

At the October 4 dinner meeting held at the Statler Hotel, 98 members and guests were present. This was the first meeting of the 1961-1962 season.

Commander Karl Breneman, USNR, Commanding Officer, USN Public Relations Company 11-4, was guest speaker. Commander Breneman spoke on the cooperation that exists among the Armed Forces.

To illustrate his points, Commander Breneman presented a film entitled "A Force in Readiness." The film was narrated by Jack Webb and showed the Marine Corps using modern equipment and weapons. The material for the film was written by Colonel Bill Hendricks, Commanding Officer, USMC Reserve Unit, Santa Monica. Mr. Hendricks is publicity director for Warner Brothers.

San Francisco

The September 21 chapter meeting was held at the Hewlett-Packard Company, Stanford Plant. A tour was conducted by George Climo, Employee Relations Coordinator of the company.

The Hewlett-Packard Company started in 1939 in Palo Alto and now occupies a total floor area of 387,500 square feet. The Company employs about 2300 people.

Colonel Guy H. Rockey of Western Communication Region, Hamilton Air Force Base was elected to the Board of Directors.

EUROPEAN REGION

Italian

The application for the new chapter charter was approved by AFCEA headquarters on October 16, 1961.

At an organizational meeting held September 26, newly elected officers were: president: Captain J. M. Grider, USN; vice presidents: M. Maffei, and Lieutenant Colonel J. Miller, USA; secretary: B. Prezioso; and treasurer: Lieutenant Commander L. J. Farmer, USN.

The official charter will be presented at a subsequent date.

Paris

Fifteen members of the Executive Committee met at the Seine Area Command Officers Open Mess on October 19.

Those appointed to the membership committee are A. deBondini, chairman, and J. R. Pernice, and three service officers to be announced by Major General F. W. Moorman, USA, for SHAPE; Rear Admiral T. A. Torgerson, USN, for EUCOM; and Colonel J. D. Rouge, USA, for AFCENT.

Those appointed to the program committee are Dr. M. E. Deloraine, Dr. M. Ponte, and Brigadier General K. E. Zitzman, USA (Ret.), with Commander W. L. Bushy, USN, an ex officio member.

CHAPTERS AT LARGE

San Juan

Ladies Night was held August 20 at the Fort Buchanan Officers Club. Music was furnished by the U. S. Navy Steel Band. Approximately 100 members and guests attended.

A dinner meeting was held at the Officers Club, Fort Brooke, Puerto Rico on October 19. Lieutenant Nyle of the Antilles Signal Office at Fort Brooke spoke on the Army's new automatic Teletype Radio Center in the mid-western section of the United States. Lieutenant Kyle presented also pictorial diagrams and other data on the progress of the Army Signal Corps from the date of its inception.

Association News

AFCEA Life Membership

At the meeting of the Board of Directors of the Association on 8 March. 1961, by a motion made and seconded, the membership dues for a life membership in the Association were changed from $50.00 to $100.00. Following the meeting, this information was forwarded to our chapters and to others particularly concerned.

While we are receiving new life memberships for $100.00 at a goodly rate, we find that many memberships are received at the old $50.00 rate.

We feel that this results from the fact that there are still a few of the old application forms for membership in the hands of our chapter members, and that when the word was passed, it was not fully disseminated to everyone.

National Headquarters would be most appreciative if everyone would take cognizance of the new rate change.

Honor Graduate Awards

The following eight officers graduating with top honors from the U. S. Army Signal School, Fort Monmouth, were presented the AFCEA Award for outstanding scholastic achievement.

Signal Officer Basic Course: 2nd Lieutenant Peter Buttner, Homewood, Illinois; Massachusetts Institute of Technology; 2nd Lieutenant William Hellier Jr., Atlanta, Georgia; Davidson College.

Associate Signal Officer Career Course: 1st Lieutenant Willard E. Lockwood, Miami Florida; University of Miami.

Signal Material Maintenance Officer Course: 2nd Lieutenant Charles R. Mauldin, Birmingham, Alabama; Auburn University.

Microwave Radio Officer Course: 1st Lieutenant Donald B. Griggs, Damascus, Maryland; Johns Hopkins University.

Signal Supply Officer Course: 2nd Lieutenant Richard A. MacGregor, Long Branch, New Jersey.

Electronic Warfare Analyst Officer Course: Captain Edward D. Resnik, USMC, Hollwood, Florida.

Communications Center Operations Officer Course: 2nd Lieutenant Gary D. Peterson, Antion, Iowa; Iowa State University.

AFCEA Hams Re-elected to American Radio Relay League Posts

Charles Compton, WOBUO, Senior Engineer in Minnesota Mining and Manufacturing Company's Central Research Department at St. Paul was re-elected Director of the Dakota Division of the American Radio Relay League (ARRL). Colonel Edwin S. Van Deusen, USA SigC, (Ret.), W3ECP was again re-elected Vice-Director of the Atlantic Division.

Robert Booth, W3PS, Chairman of the Federal Communications Commission's Bar Association was appointed ARRL's legal counsel by the Executive Committee.

Mr. Compton, Colonel VanDeusen, and Mr. Booth are active members of AFCEA.

General Dreyfus Joins American Tel. & Tel. Co.

Major General James Dreyfus, USA, (Ret.), former Director, Communications-Electronics, Joint Chiefs of Staff, has joined the American Telephone and Telegraph Company as Executive Assistant to the Vice President-Defense. General Dreyfus is an honorary life member of AFCEA.

General Dreyfus, who will have his office at AT&T's New York headquarters, 195 Broadway, will concentrate on new and improved communications services required by the increasing complexity of defense operations and administration.

New Group Member

Pacific Northwest Bell Telephone Company has joined the Association as a new group member. M. J. Sullivan, Contract Service Supervisor, has been named company representative.

Those named to be full members are: E. W. Anderson, General Facilities Engineer; E. C. Hathaway, Defense Facilities Supervisor; H. G. Higgins, Contract Service Supervisor; L. C. Irwin, Equipment and Building Engineer; F. B. Mossman, Division Plant Manager—Toll; R. J. Mutchler, Plant Operations Supervisor; R. W. Pace, Defense Communications Engineer; H. Scherner, Area Defense Coordinator; C. E. Steele, Defense Activities Director.

Pacific Northwest Bell Telephone Company will be affiliated with the Seattle Chapter.

NEW AFCEA MEMBERS

Listed below are new members of AFCEA who have joined the Association during the month of October. Members are listed under the chapter with which they are affiliated. Amateur radio operators are listed with their call letters.

Alaska

Earl L. Albin
Maj. L. J. Decuir, USAF
Eugene J. Doherty
Gordon B. Finigan
L. J. Hargis
Conrad W. Leburn
Elmer Niemoeller
James S. Ralph

Arizona

Abraham Ringer

Atlanta

J. Allen Davis, W4G2N
Howard T. Davis
Franklin O. Efird
Stuart J. Haney
W. M. Kinsman
Wilma L. Minix
Lt. Col. W. F. Rogers, USA
Joseph O. Stonecipher
Ruffus H. Weeks
J. W. Williams

Augusta-Fort Gordon

2nd Lt. J. R. Adams
Lt. Kenneth Albert
2nd Lt. F. R. Alessandri
2nd Lt. John E. Anderson
2nd Lt. D. J. Baseler
2nd Lt. M. E. Basile, Jr.
SSGT. Willie P. Beaulieu
2nd Lt. F. B. Beckette
2nd Lt. Harvey G. Berig
2nd Lt. I. O. Berkhan
2nd Lt. B. L. Bottoms
2nd Lt. J. D. Bronzino
2nd Lt. Milton D. Brooks
2nd Lt. David A. Browning
2nd Lt. Roberto D. Capriles
2nd Lt. Richard B. Carey
M-Sgt. Peter E. Casalino
1st Lt. Adolph Caso
William I. Cheney
2nd Lt. E. T. S. Chung
2nd Lt. Ian D. Dunipace
2nd Lt. Marcus S. Edwards, Jr.
2nd Lt. Edward W. Elkinson
M-Sgt. Marcel F. Faucher
2nd Lt. Joseph P. Ferrara
W. T. Fleming
2nd Lt. Franklin W. Floyd, Jr.
2nd Lt. Virgil G. Fox
2nd Lt. James A. Francis
2nd Lt. Fritz R. Franke
2nd Lt. Richard Garber
2nd Lt. S. L. Gazoorian, Jr.
2nd Lt. R. G. Gregg
2nd Lt. Manuel Griego
2nd Lt. Albert N. Griggs
2nd Lt. C. V. Grindell
2nd Lt. A. R. Gudrian
SMSgt. A. C. Hardy, Jr., USAF
2nd Lt. Thomas A. Hawk
M-Sgt. Roy L. Hefner
2nd Lt. E. V. Herrmann, Jr.
2nd Lt. Charles L. Hoffman
2nd Lt. C. J. Holderness
2nd Lt. Neil B. Hollis
Capt. Bruce K. Houston, USA
Arlo D. Janssen
Capt. Luther B. Johnson
2nd Lt. K. E. Jury
2nd Lt. Bruce Kane
2nd Lt. Brian S. Kelly
Lt. Robert L. Kelley
2nd Lt. Cecil B. Kelley, Jr.
Lt. Edward N. Kemper
2nd Lt. Janis V. Kenigs
2nd Lt. D. C. Kennedy, III
2nd Lt. Peter B. King
2nd Lt. E. F. Knight, Jr.
2nd Lt. Louis M. Krasny

2nd Lt. R. R. Labbe
2nd Lt. D. L. Lange
2nd Lt. R. R. Lesieur
2nd Lt. J. G. Markrodanis
2nd Lt. Kenneth R. McCormick
Captain Donald F. McDonald, USA
SFC Hugh M. McInnes
2nd Lt. Robert P. McMahon
2nd Lt. Kenneth S. McTaggart, K6SRM
2nd Lt. John A. Moyer
2nd Lt. Forrest J. Murphy
2nd Lt. Gerardo A. Navas, USA
2nd Lt. John T. Nelson
2nd Lt. Richard J. Nielsen
2nd Lt. Malcolm Niles
2nd Lt. Charles K. Olivet
Lt. William A. Odafuji
2nd Lt. Glen S. Parsons
2nd Lt. David H. Peirez
2nd Lt. D. F. Perkinson
2nd Lt. Robert W. Peters
2nd Lt. Robert W. Pitts, Jr.
Capt. Donald J. Pomeroy, USA
Lt. Murrell W. Price
Lt. Robert W. Pryor
J. Pugliese
2nd Lt. R. C. Randt
2nd Lt. Charles E. Redmond
John C. Rogers
2nd Lt. Melvin L. Roths
Lt. Edwin Rudberg
Major James E. Samuel, USA
2nd Lt. W. A. Schaefer
2nd Lt. Carmine Schembri
Ralph C. Scott
Major Alvin L. Smith, Sig.C .
2nd Lt. Marvin E. Smith
2nd Lt. R. P. Smith
2nd Lt. Robert L. Munroe
2nd Lt. Jerry J. Sonderman
2nd Lt. R. E. Stynes
2nd Lt. Steven Swartz
2nd Lt. David L. Townley
2nd Lt. Arlo J. Trieglaff
2nd Lt. W. W. Vaught
2nd Lt. Charles C. Vessels
2nd Lt. Edward W. Voigtman, W9GSS
2nd Lt. P. W. Williams
2nd Lt. S. Winnick
2nd Lt. Wayne B. Walker
Lt. Guy E. Womack

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Ralph P. Helfen
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Arthur Orenberg
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Cape Canaveral

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William H. Roberts
Gustave M. Thynell, W4LEY

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Otto H. Brown, Jr.
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Gerard A. Smith
Richard W. Swanson
Lt. Col. F. C. Stockton, USAF
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H. E. Reavis
J. J. Williams

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Col. Charles W. Flint, USA
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Morey W. Eggleston
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John F. Martin
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D. L. Williams

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SSgt. R. P. Burger, USAF
Sgt. John C. Green, USAF
1st Lt. Louis D. Kjeldgaard, USAF
Maj. C. H. McKinney, USAF
Maj. K. A. Runeberg, USAF
A1C Thomas V. Terry
Richard B. Thompson

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Merriman F. Bosley
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Tatsuo Furuta
Sosei Nishihira
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LCdr. John E. Butles, USN
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Francisco A. Arrieta
Lawrence C. Barber
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Umberto Donato
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Scott-St. Louis

Layton H. Grier
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Leland S. Denning W4ESH
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Michael Metro Marks
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James Ford
Stephen H. Forman
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David Potter, K1MBO
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R. T. Cox
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Capt. Robert W. Morrow, USAFR
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Model 538-A has indefinitely long life — requires no maintenance or adjustments. It is a direct electrical and mechanical replacement for WE 255A Polar Relay used in Teletype machines and Central Office Telegraph repeaters. It upgrades and **increases reliability and** speed of associated equipment. Purely resistive input and complete isolation between input and output circuits permits any number to be used in series on the same signalling circuit. Switching capabilities rated up to 500 volts DC and up to 2 Amperes at 100 watts.

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NEWS ITEMS AND NEW PRODUCTS

The decision of the Department of Defense to sponsor the establishment of a full-time organization of business management specialists to be known as the Logistics Management Institute and the selection of the Chairman of the Board of Trustees have been announced by Deputy Secretary of Defense Roswell L. Gilpatric.

At the direction of the Secretary of Defense, the Materiel Assistant Secretaries examined Defense Department policies and practices concerned with determining: What to buy; How much to buy; and How to buy most economically and efficiently. This review has identified a number of highly complex problems of long standing.

Secretary McNamara has concluded that the magnitude of these problems is such that the most experienced, capable and creative business management talent must be brought to bear on them to assist in their solution. To meet this need, the Department of Defense is sponsoring the establishment of a special full-time organization of highly talented business management specialists. This organization, known as the Logistics Management Institute, "will be a non-profit, fact-finding and research organization, guided by a group of Trustees of national reputation, and supported by a contract with the Defense Department."

For some time, the principal focus of the Institute will be on studies to improve defense procurement.

Chairman of the Board of Trustees is Charles H. Kellstadt, Chairman of the Board, Sears, Roebuck & Company. Trustees include: Maj. Gen. Frederick J. Dau, USAF (Ret.), Vice Pres., Champion Paper & Fibre Co.; Peter F. Drucker, Chairman of the Management Area, Graduate School of Business, New York University; Robert J. Nordstrom, Chairman, Mershon National Security Program, Ohio State University; Dr. Carlton A. Pederson, Associate Dean, Graduate School of Business, Stanford University; Dr. Stanley F. Teele, Dean, Graduate School of Business Administration, Harvard University; and Charles E. Wilson, General Electric Company.

The Trustees will guide the Institute in choosing the best talent and concentrating on the highest priority problems. The Trustees will meet quarterly to review the business affairs, work program and products of the Institute and to advise in the selection of its key personnel.

Principal officers of the Institute will consist of an Executive Director, a Research Director and a Business Manager. Dr. J. Sterling Livingston of the Harvard Business School will serve as Acting Executive Director until a permanent Director is selected by the Trustees. A staff of ten to fifteen senior men with broad consulting and research experience in procurement and logistics will be responsible for the Institute's research efforts, including the supervision of studies subcontracted to universities and private consulting firms when their specialized talents are required.

• • •

New York Research & Development Team, Inc., has announced receipt of final Small Business Administration approval permitting the Team to bid as a technical pool on military and commercial research and development projects. The action marks the first SBA sanction of this specialized type, according to Cyrus Adler, president of the R&D Team.

The SBA decision required approval of the U. S. Attorney General and concurrence of the Federal Trade Commission Chairman.

The New York Research and Development Team was formed in May 1960, with headquarters at 150 Broadway, for the purpose of undertaking specialized projects in the fields of electronics, nucleonics, chemistry, optics, mathematics and physics. The Team is presently comprised of four companies. Membership will be augmented through the addition of several well known New York area firms now that government approval has been obtained. Present members are: Aerolite Corp., Union City, N.J.; Manhattan Physical Research Group, Inc., N.Y.C.; New York Testing Laboratories, N.Y.C.; and Radiation Research Corp., Westbury, L.I.

• • •

Shipments of selected electronic components in the second quarter of 1961 gained about 3 percent over the first quarter level, the Electronics Division, Business and Defense Services Administration, U.S. Department of Commerce has reported. Military shipments increased roughly 2 percent and non-military about 4 percent. The second quarter 1961 output was also about 3 percent above the same period in 1960. Non-military shipments were up about 6 percent from a year ago and military shipments down about 1 percent.

The strong upward trend in unit sales of semiconductor devices has been accompanied by substantial price reductions. Unit shipments of germanium transistors increased 68 percent from the second quarter of 1960 to the same period of 1961; germanium diodes increased 66 percent; silicon transistors, 39 percent; and silicon diodes, 13 percent. However, during the past 12 months average unit prices of germanium transistors decreased 31 percent; germanium diodes, 38 percent; silicon transistors, 34 percent; and silicon diodes, 31 percent. Declining prices caused a reduction of nearly 11 percent in total dollar volume of silicon semi-conductor sales from a year ago, but despite falling prices shipments of germanium devices rose about 13 percent in total value.

Output of most other major categories of components increased in value during the second quarter over the preceding period. Slight decreases were reported, however, in sales of resistors, down 1 percent and in television picture tubes, down about 4 percent.

• • •

A call for nominations for the tenth annual Edison Radio Amateur Award for outstanding service has been issued by L. Berkley Davis, chairman. Mr. Davis is vice-president in charge of the General Electric Company's Electronic Components Division, sponsor of the award.

Nominations of radio amateurs who have performed public services in 1961 must be postmarked no later than January 3, 1962, and addressed to Secretary, Edison Radio Amateur Award Council, G. E. Co., Owensboro, Kentucky.

Nominations may be submitted by any person or group familiar with a public service performed by a radio amateur. Complete details of public services performed should be included to facilitate judging. A "Guide for Preparing Nominations" will be sent to those requesting it.

Can you increase the effectiveness of the electronics men in your command—at no cost to the Service?

THOUSANDS of men in the Armed Forces—from the lower enlisted ratings to high-ranking officers—are today enrolled in CREI Home Study Programs in Electronic and Nuclear Engineering Technology. These men are instructors at military technical schools. They are nuclear and electronic specialists. They are sonar men, radar men and guided missile technicians. They may be found wherever the Armed Forces have need of advanced technical skill.

These men are gaining increased technical knowledge above and beyond the scope of Service courses. They are improving their effectiveness both as technical specialists and as military men. And, since they study in off-duty hours and pay tuition out of their own pockets, this improved knowledge and skill costs the Service nothing.

CREI Programs are not easy. The CREI man spends long hours studying such subjects as solid state physics, calculus, differential equations, probability and statistics, design logic, radar, computers and instrumentation—to name a few. If you've been away from text books for some time, you might find his technical assignments down-right tough.

What about the men in your command? Are any of them CREI men? Why not take time soon to give their unusual efforts some encouragement. Do any of your men qualify for CREI Home Study Programs? Qualifications include completed high school education and prior experience or training in electronics plus the will and ambition to apply themselves to serious study.

Why should your men choose CREI? One reason: CREI consistently maintains high academic standards and accredited curricula. Another: Some of the Nation's leading scientists (including men from such government scientific agencies as Naval Research Laboratory, Diamond Ordnance Fuze Laboratories, National Bureau of Standards and Federal Aviation Agency) help prepare CREI programs and keep them current with new technical advances. Still another: CREI has been serving the Armed Forces for 34 years. During World War II, CREI was selected to prepare and conduct special technical courses for the Navy, the Signal Corps and the Coast Guard. Today CREI numbers among its home study students thousands of Navy, Army, Air Force, Marine Corps and Coast Guard technical personnel. CREI programs are approved for reimbursement by all three branches of the British armed forces.

Welcome the CREI Field Service Representative who calls on your men. It is his job to help increase their effectiveness in the Armed Forces and to help them become better technically qualified men.

We invite your comments about CREI men in your command—or write for a complimentary volume of typical CREI technical study material. Your letter is important. Send it to the President of CREI for a personal reply.

CREI

The Capitol Radio Engineering Institute

ECPD Accredited Technical Institute Curricula • Founded 1927

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Candidates must hold valid amateur radio licenses issued by the FCC and must have performed the public service cited in pursuit of their hobby. The principal recipient will be selected on the dual basis of 1) his personal sacrifice and 2) the benefit of his service to an individual or group. In past years the judges also have chosen other candidates to receive special citations for their meritorious service. Results will be announced late in January, 1962 and presentation of the award trophy and $500 will be at a banquet in Washington, D.C., in February.

Nominations will be judged by an impartial panel consisting of: E. Roland Harriman, chairman of the board, American National Red Cross; Commissioner Rosel Hyde, Federal Communications Commission; and G. L. Dosland, president, American Radio Relay League.

The awards have been made in the past in recognition of public service in hurricanes, floods and other disaster situations; in training and educating youths in electronics; in helping servicemen and others overseas; and for technical achievements. Last year the award was shared by two radio amateurs who set a long distance communications record under circumstances long believed impossible. They communicated regularly over a period of time between Hawaii and California using ultra-high radio frequencies.

• • •

First steps to consider consolidation of the American Institute of Electrical Engineers and the Institute of Radio Engineers have been taken. In a resolution passed by the Boards of Directors of both Societies, a committee has been formed to determine the feasibility and form of such consolidation. The committee is to submit a report not later than February 15, 1962 for approval to the Boards of both Societies, "with a view to submission to a vote of the memberships of the two Institutes and consummation, if so approved, by January 1, 1963."

The proposed new organization would be international in scope and involve 150,000 members.

• • •

Establishment of a Science Resources Planning Office in the National Science Foundation has been announced. The Office will serve as a focus for studies of the nation's future needs and resources for research and education in science.

Dr. Richard H. Bolt has been named to head the SRPO and to occupy a new Foundation position, Associate Director (Planning). Since January, 1960, Dr. Bolt has served as NSF's Associate Director (Research).

SRPO, in studying science resources, will use information developed in cooperation with educational institutions, with industry and with government agencies. It will also encourage and sponsor relevant studies by other organizations, both public and private. In carrying out its responsibilities, The Office will be responsive to the needs of the Federal Council for Science and Technology and of the Office of the President's Special Assistant for Science and Technology.

• • •

The U. S. Air Force has announced the completion of a new link in the Defense Communications System which links Anchorage, Alaska with Shemya at the western tip of the Aleutian Islands.

The new segment, designed to provide instantaneous rearward communications from the Air Force installation at Shemya, consists of a three-station "tropospheric scatter" radio relay network between Nikolski and Shemya which was engineered, installed and tested by the Western Electric Company. It ties in existing Alaskan communication networks from Anchorage to Nikolski.

• • •

A powerful 160-million electron volt proton beam generated by a Navy cyclotron located at Harvard University has been used to treat a deep-seated brain tumor, making the first application of a new technique in treating tumors in a human.

The pioneering procedure, which utilizes the Bragg peak of the proton beam to produce controlled lesions, was developed through experimentation with animals. The patient was a two-year-old girl who was diagnosed last spring as suffering from a brain tumor that could not be removed by surgery and which was considered to be fatal. The penetrating capability and range of the proton beam generated by the 160 MEV cyclotron at Harvard was considered suited to treating the child's particular type of tumor.

Following a series of three exposures to the beam spaced two weeks apart last May and June, the tumor shrank to 20 percent of its former size. The child gained eight pounds from a former weight of 19 pounds and is now at home where, according to medical reports, she "plays happily with other children and has an emotional and motor performance compatible with her age." The only symptom that remains is a mild visual defect.

The final outcome, however, will not be determined until the child has been under observation for some time. She is scheduled for X-rays within a few months to check on her progress and to see if there has been further reduction in size of the tumor.

• • •

The British Broadcasting Corporation has placed an order with Marconi's Wireless Telegraph Co., Ltd. for the supply and installation of ten high-power (250 kw) short-wave sound broadcasting transmitters to improve overseas listeners' reception.

Six of these transmitters will be installed at the Voice of America relay station at Woofferton. Two more will go into service at the BBC station at Rampisham and the remaining two at Daventry. The transmitters are especially designed to combat the ever increasing amount of interference experienced by overseas listeners on the short waves. This is achieved by employing a method of modulation which cuts through interference. Intensive experiments have shown that the use of this trapezoidal modulation, as it is called, gives an intelligibility at the receiving end which could only otherwise be

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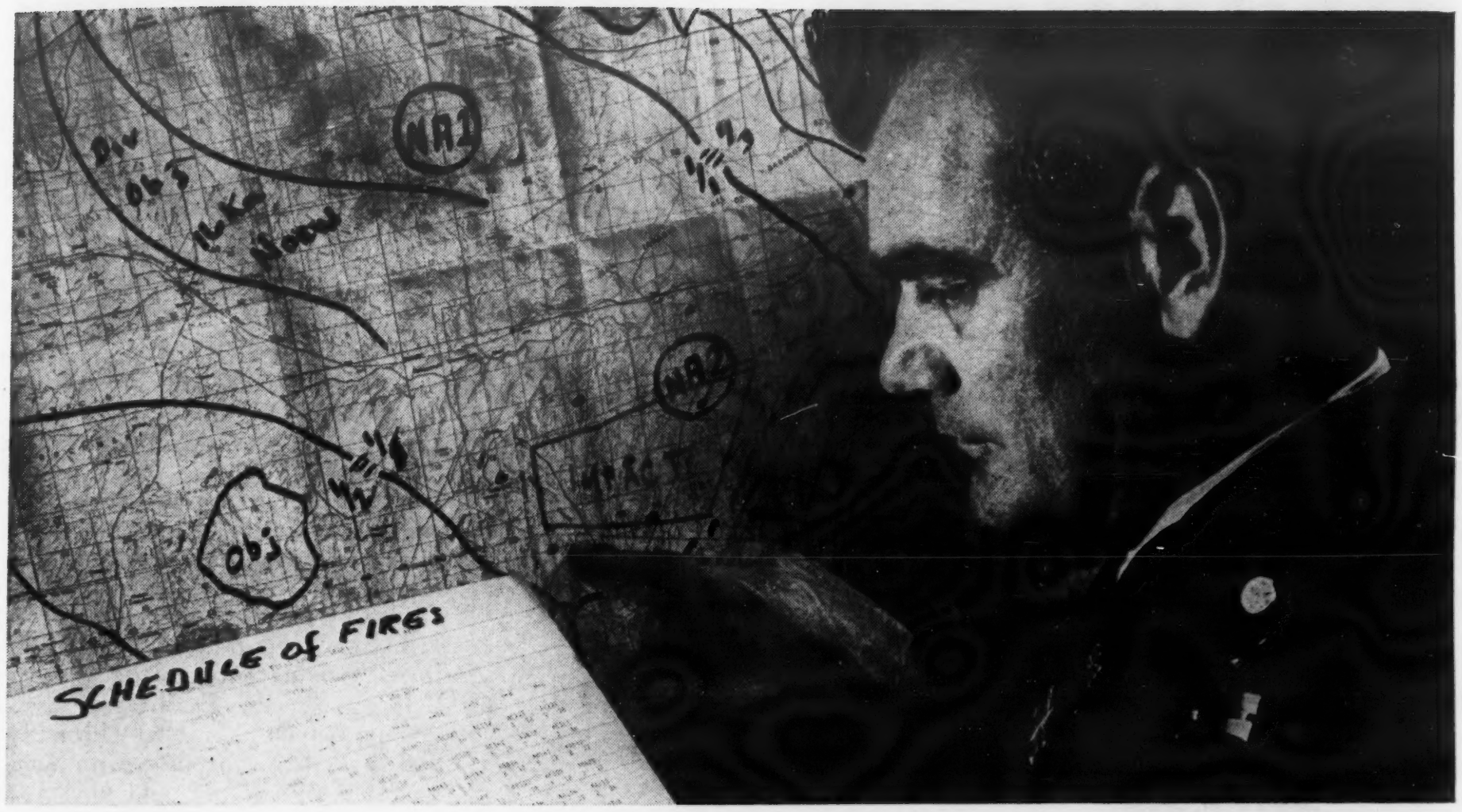


AUTOMATED ARTILLERY FIRE PLANNING

TRADING HOURS FOR MINUTES WHEN IT COUNTS

Targets to destroy... troop movements to cover... a bridge to save... a gun emplacement to wipe out... a precisely coordinated schedule of firepower and manpower and brainpower.

The Divisional Fire Plan, prepared automatically by electronic computers in 12 minutes, tells the captain where every artillery battery will hit – and when. He checks his Schedule of Fires against the tactical map, applying human judgement, experience and intelligence to the information supplied by the computers. If he wants to, he can alter or refine the schedule –even scrap it completely and have a new one in his hands in a few minutes.

A simulation exercise today; a powerful system in the field tomorrow.

At recent exercises, an Army-Industry team successfully demonstrated that automatic data processing systems can help to reduce the time it takes to prepare a Divisional Fire Plan from a matter of hours to a matter of minutes. When computers process ballistic solutions at electronic speeds, they aid in achieving first-round target hits. This means saving ammunition – conventional or nuclear. It also means surprise – hitting the target while it is unprepared and vulnerable. The long-range program of developing Command Control Information Systems is now being extended to other Tactical Field Army functions, utilizing the FIELDATA family of equipment.

Development and testing of artillery fire planning and control systems are being done by the U.S. Army Electronic Proving Ground, Fort Huachuca, Arizona, with the cooperation and support of the U.S. Army Artillery and Missile School, Fort Sill, Oklahoma. Technical assistance is being provided by Ramo-Wooldridge, a Division of Thompson Ramo Wooldridge Inc.

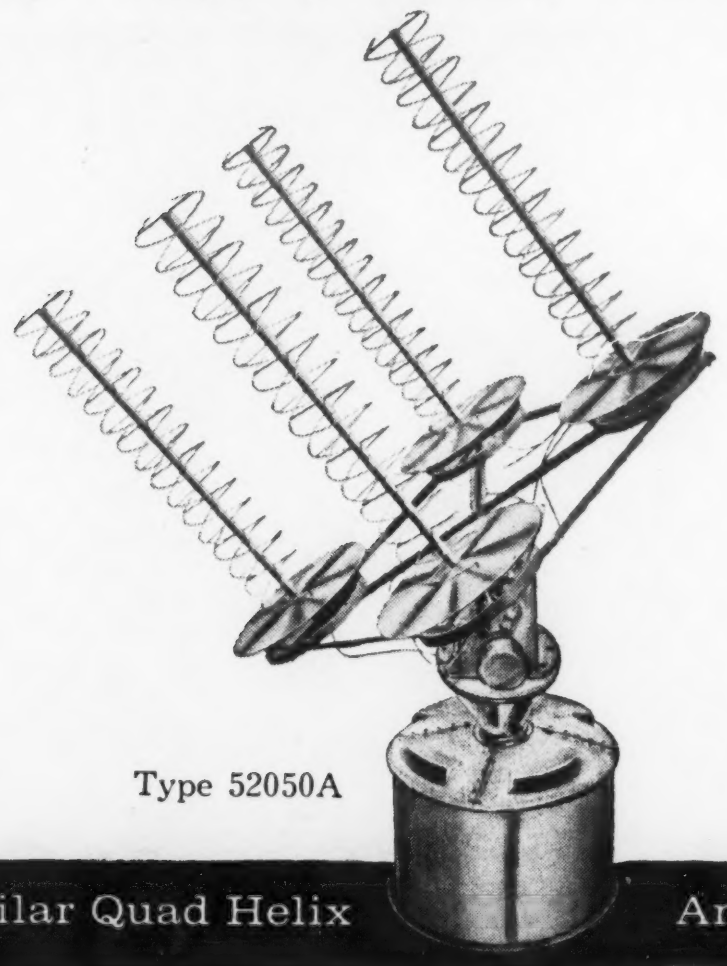
Challenging openings now exist at Ramo-Wooldridge's Fort Huachuca office for experienced computer programmers, systems analysts and test and applications engineers. All qualified applicants will receive consideration for employment regardless of race, creed, color or national origin.

Contact Mr. R. J. Kremple

Thompson Ramo Wooldridge Inc. **RW** Division
8433 Fallbrook Ave., Canoga Park, Calif., Diamond 6-6000

10-11A

SPACE COMMUNICATION ANTENNAS



Type 52050A

Bifilar Quad Helix Antenna

ANDREW

ANDREW Type 52050A telemetry antenna system is a step forward in the design approach of antennas used for maintaining reliable contact between missile (or satellite) and ground installations. The BIFILAR* quad helix array consists of 4 BIFILAR helices on individual ground screens, oriented to provide optimum radiation patterns for the 215-265 mc telemetry band.

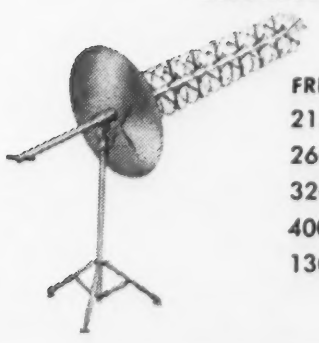
*Patent Pending

Gain is 19.3 db and beam width 16.5 degrees at 240 mc. VSWR is less than 1.8:1 across the 215-265 mc band. Polarization is right hand circular.

OTHER ANDREW GROUND TO AIR ANTENNAS

PARABOLIC ANTENNAS

FREQUENCY	GAIN	TYPE NUMBER
1400-1600 mc	26 db	51855
2200-2300 mc	29 db	51860



HELICAL ANTENNAS

FREQUENCY	GAIN	TYPE NUMBER
215-265 mc	14 db	52000-2
260-320 mc	12 db	H19110A-3
320-400 mc	13 db	H19110A-4
400-550 mc	11.5 db	H19110B-5
1300-1600 mc	13 db	H19110A-11

DISCONE ANTENNAS

Six models of this unity gain omni-directional antenna are available for complete coverage of the 25-1500 mc range.

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brought about by more than doubling the transmitter power—that is, in this instance, from 250 kw to 550 kw.

The main valves, which are of English Electric Valve Co. manufacture, are vapour cooled. The overall efficiency of the transmitter is approximately double that of the older equipments supplied to Rampisham and Daventry, the company reports.

The frequency range covered is 3.95—26.1 Mc/s.

• • •

Bell Telephone Laboratories have reported the successful growth of a new form of crystal silicon. Bell scientists have grown from the vapor "ribbons" of silicon which are so thin they are semi-transparent. The ribbons, typically about one micron thick are near-perfect crystals. Their mechanical properties appear to resemble those of the ultra-strong "whiskers" reported by Bell Laboratories several years ago.

In the process for making silicon ribbons, silicon is reacted with iodine and hydrogen, together with small amounts of arsenic and nickel at high temperatures in a closed tube. The ribbons, together with silicon whiskers of a hexagonal cross-section, grow rapidly in the hot tube. The ribbons vary from 0.1 to 15 microns in thickness, are about 0.1 millimeters wide and from one to three centimeters long. They contain few or no crystal defects except for a single twin plane parallel to the ribbon surface. The twin plane, plus what appears to be a growth poisoning effect of certain impurities, cause the crystal ribbon to grow rapidly in length but relatively slowly in width and thickness.

• • •

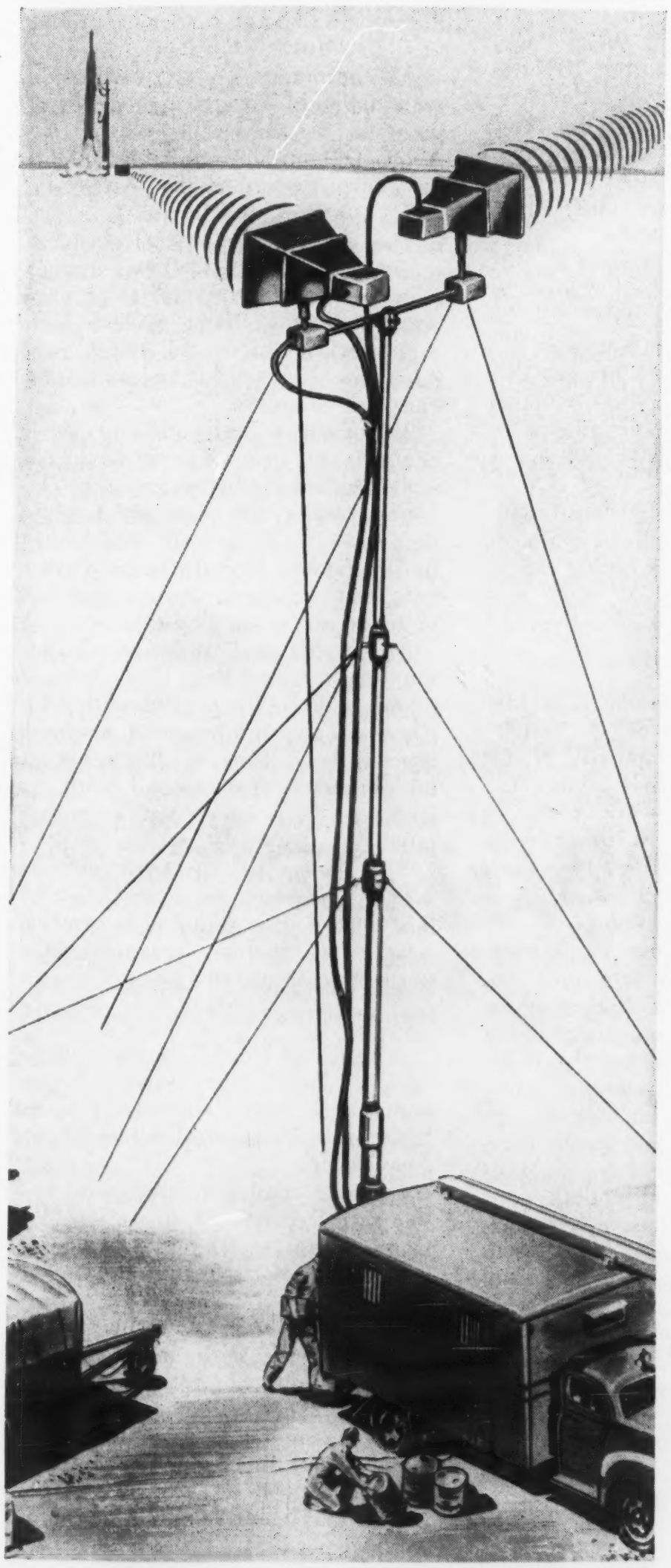
International Business Machines Corporation has announced a plan to make interest-free loans of up to $1,000 to domestic employees for the purpose of building family fall-out shelters. The loans may be repaid in three years by payroll deductions.

Board Chairman of IBM, Thomas J. Watson, Jr., said that no significance should be attached to the timing of this plan. He pointed out that the decision evolved over a considerable period of time and is not related to something that just happened or that the company thinks will happen.

In addition to the shelter loan plan, IBM is making quantity purchases of radiation measuring devices, survival food kits and other shelter equipment and supplies which may not be readily available locally. It will make these supplies available to employees at the company's purchase price.

RCA Mobile Microwave

for Communications where needed... when needed!



Mobile Station RCA MM-18 Microwave Communication System with portable tower

Standard MM-18 Microwave packages are available from RCA to provide extremely flexible communications systems for mobile applications. Similar to famous RCA equipment that has been proved in use by over a million channel miles, this MM-18 Mobile System provides a broad radio highway over which many teletype channels and duplex voice channels can be operated simultaneously. The directivity of the radio beam and the multiplexing of the communication channels assure a high degree of security for transmitted messages. Truck-mounted, the portable RCA Microwave System also includes a tower that can be rapidly raised and easily transported from one place to another. RCA Mobile Microwave performance matches the reliability found in fixed stations.

MM-18 Systems Ideal for:

- Remote missile bases.
- Command posts to remote launching pads.
- Command post installations for field maneuvers.
- Siting teams requiring high mobility.
- Emergency installations—Civil Defense.

Experienced Microwave engineers will gladly provide additional information. Contact RCA, Dept. C-291, Bldg. 15-1, Camden 2, N.J. or telephone WOodlawn 3-8000, Extension PC-4560.

Also, New MM-600 Microwave Systems. Long haul, high-density systems for fixed installations. Designed to comply with CCIR/CCITT performance standards. Channel capacity of 600 frequency-division multiplexed voice circuits plus service and alarm channel. Alternately, one r-f channel will accommodate 525-line monochrome television; NTSC color TV or 685 CCIR television.

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RADIO CORPORATION OF AMERICA

The National Bureau of Standards has received an appropriation of $1,000,000 of U. S. owned foreign currencies to be used for scientific research in foreign countries. Dr. Franz L. Alt, Coordinator of Special International Programs, will handle the establishment and operation of the projects. This is the first time that NBS has received an appropriation from the foreign currency funds which have accumulated from the sale of U. S. surplus agricultural products to foreign governments.

The research programs will be undertaken in India, Pakistan and Israel.

• • •

By treating very short radio waves as lightwaves, Dr. William Culshaw of the National Bureau of Standards Boulder Laboratories has developed a technique for probing millimeter waves. The basic development, a reflector to resonate these waves, can be used with associated equipment to determine the length of millimeter waves, or to investigate various materials when exposed to these waves.

Radio waves are normally resonated in a metal box. The box is built to precise dimensions, depending upon the wavelength involved, to achieve maximum resonance at different frequencies. The Bureau device, however, differs from previous resonators in that it has two perforated ends made of polished brass or silver and no sides. The holes in these plates act as transformers to "couple" the millimeter waves into and out of the cavity while maintaining a high Q value inside the cavity. The effectiveness of the holes depends upon their diameter and spacing, and these dimensions vary with the frequency. In an interferometer for 6-millimeter wavelengths, which uses perforated silver films, these holes are 0.0236 inch in diameter and are spaced 0.057 inch between centers.

The two plates are placed parallel to each other and millimeter waves are beamed against the fixed end of this box. Because the holes are small, only a fraction of the initial energy passes through the holes in the fixed plate. This energy strikes and is reflected by the second plate with only a fraction passing through it. As the polished metal surfaces are highly reflective, the waves that are captured inside the cavity are reflected back and forth, and when the plates are properly spaced, the cavity resonates. When the spacing between the plates is correct the transmission through the cavity is a maximum. Inside the cavity this condition creates an entire series of standing waves—one between each pair of holes at either end of the unit.

• • •

A solid-state operational dc amplifier featuring high gain and 200 kc bandwith is available from Imperial Thermal Systems, Inc., Buena Park, California. The Model 1090-100 was designed as a true plug-in component suitable for rigorous airborne and ground support use. It is suitable for precision applications such as a precision voltage source, integration, conversion and summation.

The unit provides a gain of 5×10^6 and a dynamic range of $\pm$20v@20 ma. Maximum drift at 25°C $\pm5°$ is 50 microvolts. Noise at output is less than 5 mv peak to peak. Because this chopper stabilized amplifier contains its own chopper power supply, a power source of $\pm$25vd-c@60 ma is all that is required.

Each amplifier is furnished with its own connector. Mechanical dimensions are 5.00″ long, including etched card connector, by 4.28″ wide and 1.28″thick. Weight is less than 10 ounces.

• • •

The Bolomistor, developed by Microwave Semiconductor & Instruments, Inc., of Richmond Hill, N. Y., uses thermal responsive devices for the detection of microwave energy.

Thermoelectric semiconductors (typified by lead telluride) have been successfully used in microwave applications, the company reports.

The MSI detector exhibits no rectification curve, but rather a steady resistance ranging from 2 to 4 ohms when encapsulated in a crystal diode package such as used for the lN23. The Bolomistor is interchangeable with the lN23 and is immediately applicable in power measurements from 3,000 to 10,000 megacycles in existing crystal holders and mounts.

The Bolomistor has a dynamic range of 50DB from —10 DBM to $\pm$40 DBM and, with further development, is expected to achieve sensitivities on the order of —50 to —60 DBM. The Bolomistor has a relatively high power capacity and can measure RF powers up to 10 watts average with a duty cycle of .0005 or peak power of 20 kilowatts, the company reports.

• • •

An electronic blood cell analyzer computer has been developed by Navigation Computer Corporation of Norristown, Penn., for the Perkin-Elmer Corp. of Norwalk, Conn.

The computer utilizes over one thousand transistors. Input information is received directly from a television camera which looks through a microscope at the blood smear. This system permits identification of blood types without the risk of human error and will be utilized to analyze blood cell mutations caused by radiation damage.

• • •

An automatic tape preparation system which converts numerical test data into punched tape encoded for AN/GJQ-9 missile checkout systems has been developed by Astrodata, Inc., Anaheim, California.

The solid state system features automatic error-detection devices which enable the operator to prepare and duplicate perfect tapes. With minor modifications, the system prepares tape encoded for any automatic checkout program.

The system perforates up to 8 channels of tape from a keyboard which includes editing features. The system takes the completed tape, duplicates it, then reads or verifies the duplicates. Decoded tape characters, test numbers, errors and bit patterns are visually displayed.

Tape is fed unidirectionally, avoiding tape rewinding. This feature allows multiple duplication with high efficiency and minimum of operator intervention. Tape is duplicated at 60 characters per second with or without verification with another tape.

The system is fitted with circuits which perforate, print and display tape information from such external sources as buffers, magnetic tape units, computers, etc.

• • •

A series of flexible bi-modal digital data acquisition systems is announced by Gulton Industries' C. G. Electronics Division of Albuquerque, New Mexico.

Offering both simultaneous and sequential modes of operation, the Gulton 1100 series units sample a number of low frequency inputs and convert them to digital form in a variety of codes. A visual in-line display on the basic model permits selective monitoring of any input channel. The system outputs have direct computer connection provisions for on-line computer entry of digital data.

The maximum sampling speed, in samples per second, is 1000 s/s. Consequently the sampling rate, in samples per second per input, is dependent upon the number of input channels. An estimation of maximum sampling rate (per channel) can be determined since the sampling rate varies inversely with the number of input channels.

The basic model includes a punched paper tape output. Its modular design permits adding special functions such as digital timers.

• • •

An automatic data recording system for research on the properties of semiconductors and electronic components has been designed and built by scientists at Battelle Memorial Institute, Columbus, Ohio.

The device automatically measures electrical properties of the specimen and records data by typing them on paper and simultaneously coding them on paper tape. The coded data can be transferred directly to punch cards and fed into a digital computer to calculate the characteristics of the specimen.

The automatic data taker can measure current, resistivity, temperature, magnetic field strength, or any other property that can be translated into a dc voltage between 1 microvolt and 100 volts. It can measure up to 17 different signals from a single specimen, 4 different signals from each of 4 specimen simultaneously, or various combinations in between.

Properties such as resistivity, Hall coefficient, magnetoresistance and thermomagnetic effect can be measured in any desired sequence and combination of sequences up to a total of 100 measurements. This set of up to 100 measurements can be repeated automatically at each of up to 100 variations in time or environmental conditions such as temperature, pressure, or magnetic field. Thus, in a single programming, the machine can take and record up to 10,000 individual measurements.

• • •

A new-type Westinghouse picture tube, mounted in a special television set made by a German electronic equipment company, produced pictures devoid of horizontal lines at the Berlin Fair last August.

The new tube eliminates the usual scanning lines by subjecting the electron beam to a small-amplitude, high-frequency deflection, thus enlarging it vertically to fill in the conspicuous black areas between the information lines.

The output of an oscillator is used to deflect the scanning spot so that it moves up and down in a sinusoidal path instead of tracing straight across the tube. If a high enough frequency is used, the individual oscillations crowd together and give the impression of a thicker line rather than just discrete cycles of oscillation.

Development of a split-focus grid device and the necessary circuitry is credited by Westinghouse as leading to the elimination of line structure in television pictures. In all other respects, the gun structure is conventional. Separate leads from each half of the split electrode are brought out through the base of the tube for connection to the oscillator. Acting as a single unit, the two halves of the focus electrode continue to control focus in the conventional way; but acting as separate units they form a push-pull pair to swing the beam rapidly up and down.

The combination of the oscillator and the split grid minimizes the need for driving power and reduces oscillator harmonics which may cause interference patterns on some channels. Experimental evidence indicates that interference is not a serious problem when the split-grid system is used. In addition, the cost of splitting the grid is small as compared to the production costs of auxiliary deflection coils. An oscillator is necessary in either case, but the lower drive requirement of the split-grid method is sufficient to result in a cost reduction in this circuit.

The experimental circuit for the Berlin Fair was built on a plug-in unit inserted between the base of the picture tube and its existing socket where filament and "B-Positive" voltages for the oscillator were available. The arrangement minimizes radiation by keeping r-f leads short.

• • •

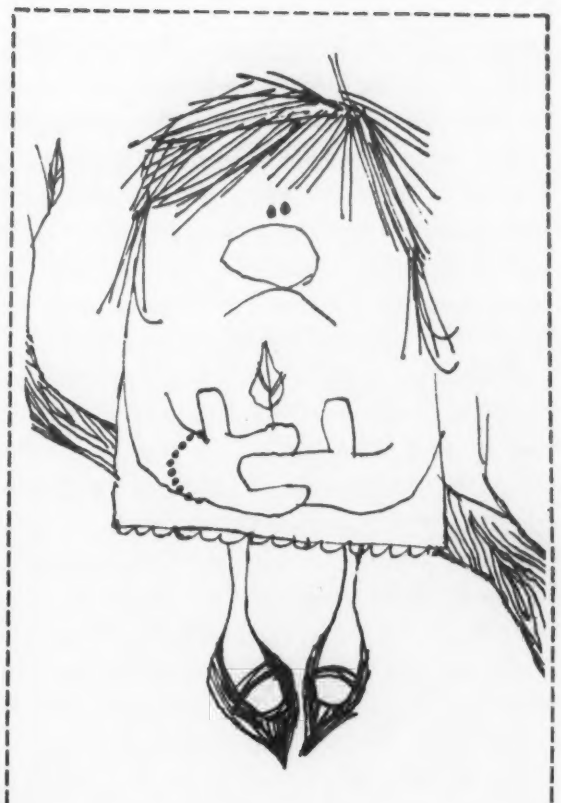
A high-speed, general-purpose computer has been developed by Computer Control Co., Inc., Los Angeles. The solid-state modular machine, the Digital Data Processor (DDP), has a 19 to 25 bit range. It is especially designed for engineering problems, including real-time simulation, control of high-speed target precision tracking, and real-time test data acquisition.

The DDP is a single address, parallel, binary, stored program machine. The 19-bit machine utilizes a 5-microsecond, 4 or 8 thousand word core memory, with additional memory units available. Four or more magnetic tape units (any or all fully buffered) can be added for further storage. Memory access time is 2.5 microseconds. Read-write cycle time between memory accesses is 5 microseconds.

Add time is 3 microseconds, average multiply time is 36 microseconds, average divide time is 45 microseconds (exclusive of access time).

• • •

Ron Electronics Corporation, Montclair, N. J., has announced a new



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Dual Signal Generator Model 210A. This unit is designed for two-tone testing of single-sideband communications systems. The signal generator is also useful for intermodulation measurements, spectrum analysis and other applications requiring the use of a signal source with low distortion or cross modulation products.

Separate calibrated frequency controls and decade (1 db step) attenuators are provided for each oscillator; this permits precise adjustment of frequency and output levels to any desired ratio. Each oscillator output is available separately or from the common combined output terminals.

Frequency range of either oscillator is 10 cps to 1 mc in five bands, harmonic distortion is 0.1 percent or less, total intermodulation products are 60 db below output level. Balanced and unbalanced outputs are provided.

• • •

A large X-Y mounted tracking antenna—designed for 360-degree coverage almost to the horizon — has been built and erected by Blaw-Knox Co., Pittsburgh, in College, Alaska, near Fairbanks.

Scheduled to be ready for operation in the spring of 1962, the new 85-foot diameter antenna will first be operated by Goddard Space Flight Center for the National Aeronautics and Space Administration in support of advanced meteorological satellite projects (Project Nimbus).

The antenna is 110 feet high, weighs 200 tons and features a 6,000 sq. ft. parabolic aluminum reflecting surface to direct incoming radio signals to a quadripod-mounted focal point. The antenna will allow operation to about 10,000 megacycles.

• • •

The U. S. Army now has a helicopter-transportable air defense system for coordinating the fire of widely-dispersed missile batteries. Helilift was developed for the Army Signal Corps by Hughes Aircraft Company and is reportedly capable of being placed by helicopter anywhere in the world.

The system, designated the AN/TSQ-38, is highly miniaturized and is installed in five or more heavy-duty plastic and aluminum shelters that can be moved rapidly from one position to another. The system consists of one "operations central" which is the heart of the system and four or more coder-decoder units.

From the operations central, an Army battalion commander monitors the air battle and assigns targets to his Nike or Hawk missile batteries by sending digital messages through the coder-decoders. The coder-decoders, located at the widely dispersed missile sites, also transmit the status of each battery to the air defense commander so that he knows the capability of his missile defense.

• • •

Motorola's Semiconductor Products Division has developed a new method of transistor operation, reportedly greatly extending the useful frequency range of transistors and increasing the high-frequency amplification capabilities of VHF and UHF units. The design has increased high-frequency circuit gain by more than 20 db in some instances and, in addition, reduced interstage matching problems and improved selectivity and stability. In the newly developed circuit, damaging inductances are neutralized by compensating methods.

A detailed theoretical discussion of circuit operation, including practical circuit data, is available from the Technical Information Center, Motorola Semiconductor Products Inc., 5005 East McDowell Rd., Phoenix 8, Arizona.

• • •

Chrysler Corporation and Kearfott Division, General Precision, Inc., have completed a series of experiments which establishes the feasibility of a fifth-wheel, odometer-type ground navigator for road mobile ballistic missiles. These tests were performed to establish the upper limit of accuracy for this type of land navigator when used on improved roads.

The experiments used the combined features of a Chrysler fifth-wheel odometer for distance traveled and the Kearfott S-121 inertial navigator for a passive, highly accurate azimuth reference system. The tests were run at speeds up to 50 mph on the completely self-contained system mounted in a Chrysler XM-410 truck over a course simulating varied terrain conditions. The tests used simple techniques which could not be detected or jammed and provided accurate position data continuously and on the run.

• • •

Texas Research and Electronic Corp., Dallas, Texas, is manufacturing an integrator, the GPI-100, which utilizes a solion tetrode as the integrating element. The device is battery powered, portable and has an input impedance of 10 K omega, a frequency response from DC to 10 kc and accepts inputs to 1 volt. The integral is read out on a 1 percent meter with both a 100 volt-second and 1000 volt-second range.

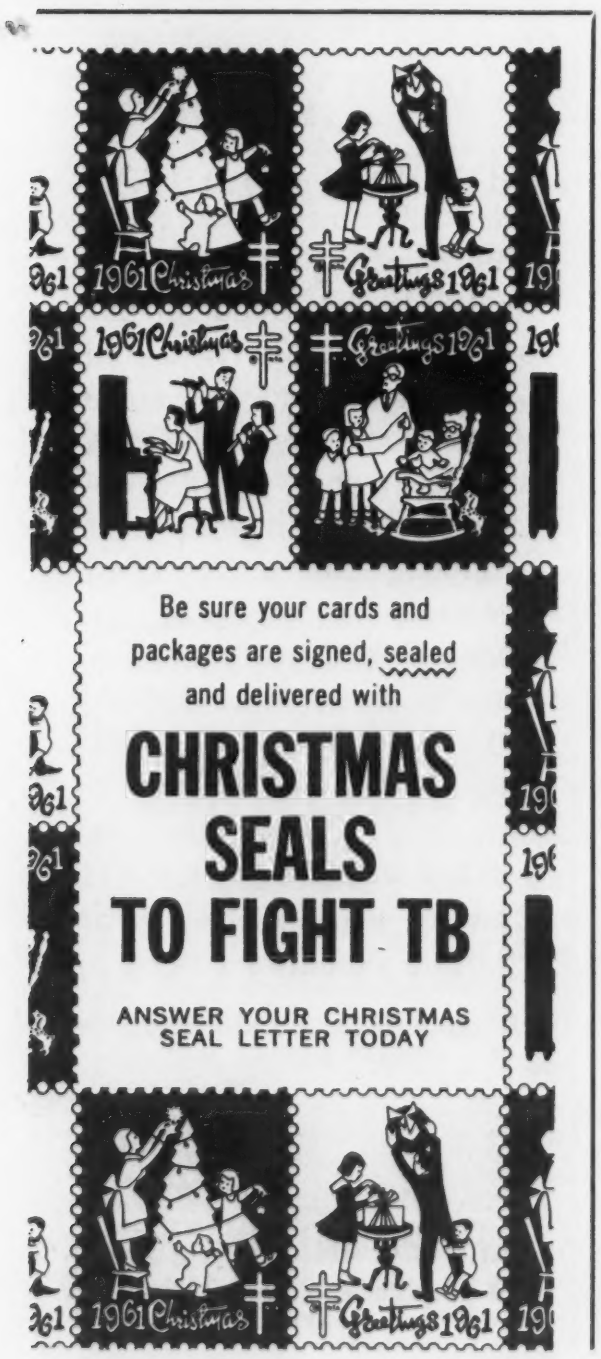
• • •

Philco Corporation has developed a low-cost coaxial cable communications repeater with bandwidth capability of 2500 voice channels. The tubular cable repeater is less than six inches long and one inch thick and weighs a few ounces.

According to the company, a cable communications system, utilizing the 2500 channel capacity repeater, initially costs about the same to install as a typical 240 channel microwave system. There is multiplexing equipment at either end of the system, as there is in a microwave system. It costs less than a cent a year to operate each cable repeater in the system and a user can tap the cable system at any point to drop or insert circuits wherever required. In a microwave system, dropping and inserting is done at the relay stations which typically are 10 to 30 miles apart.

The wire system can be buried, suspended on poles or submerged in water. The repeater has a potential capacity of 2500 two-way telephone channels. When two-way television is being transmitted, the repeater has capacity for 1000 two-way phone circuits.

The cable repeaters, installed every



mile of the system, contain duplexing filters and a transistor amplifier which receives its operating power through the coaxial cable.

The device amplifies signals in both directions. It has a total bandpass of 20 megacycles which can be divided to handle 10 megacycles in either direction.

• • •

Ampex Computer Products Co. is producing a large capacity ferrite core memory which provides a 1.5 microsecond cycle time. The random access LQ memory is designed for use with third generation commercial computers required for high-capacity, high-speed general purpose computing.

The Type LQ memory has a rate of 667 kc (1.5 microseconds) for a complete read-restore or write-clear cycle. Achieving this speed was accomplished by use of special subminiature ferrite cores, high-speed gating circuitry and the use of linear select, partial flux techniques. Power requirements for the memory are 120-VAC±10 percent, single phase, 48 to 63 cycles.

• • •

Progress in the Astronautical Sciences is a new international review series which reports advances in the various astronautical disciplines in a manner easily intelligible to the scientist or engineer, regardless of his field of specialization. The publication presents authoritative discussions on subjects selected according to the following criteria: They must be of importance to astronautics, but they also must be subjects in which recent advances have been made. More than just reviews, the articles also present new results and new ideas, particularly as they pertain to astronautics.

The selection of subjects will initially emphasize the physical sciences and technology, although some papers will be devoted to biology and medicine. International coverage is encouraged through the efforts of an international Advisory Board of Editors.

Progress in the Astronautical Sciences is to be published by the North Holland Publishing Co., Amsterdam. Editor is Professor F. S. Singer, University of Maryland, College Park, Maryland. Advisory Editors are: Prof. H. Alfven (Stockholm), Dr. H. L. Dryden, Dr. D. Flickinger (Washington, D. C.), Prof. N. Herlofson (Stockholm), Prof. H. S. Massey (London), Dr. R. W. Porter (New York), and Prof. L. I. Sedov (Moscow).

Photoprogress

The Coast and Geodetic Survey, U. S. Department of Commerce, has produced three-dimensional color photographs of the ocean floor with a deep-sea, stereo camera. The first color photographs taken have been processed to show sea life at 2,000 feet and bottom formations at more than 7,000 feet. Copies of the slides have been sent to the Smithsonian Institute for identification of marine organisms. Each slide presents a view of approximately 65 square feet of ocean bottom.

When the slides are used with stereo plotting equipment, they provide precise mapping of bottom rises with an accuracy in height to a fourth of an inch. Survey photogrammetrists have prepared a microtopographic map of the ocean floor covering 12 square feet of ocean bottom, showing contour lines every ¼ inch and slight elevations ranging from zero to three inches.

The camera, carrying its own light source, photographs the ocean bottom with 35 millimeter film through two stereo lenses. Five hundred sets of photographs can be taken at one lowering. The camera can be kept in position 10 feet above the bottom by means of an automatic control. Equipped with a sonar device, the camera sends out a sound signal, receives the return signal bounced off the ocean floor, measures the time interval and converts this into distance and makes the proper adjustment.

The camera will perform successfully in 37,000 feet (about 7 miles) of water. The next trial of the camera will be at 12,000 feet.

• • •

A Special Diploma was presented to the Air Force recently at the Italian Embassy for excellence in the 5th International Film Festival of Venice, Italy, in the category of Newsreels.

The presentation was made by Sergio Fenoaltea, Italian Ambassador to the U. S., to Major General Arno H. Luehman, Director of Information for the U. S. Air Force.

The award was earned by the Air Force News Review for a 28-minute long documentary about Air Force highlights for 1960, featuring missile and aerospace developments. The Air Force film was produced by the Air Photographic and Charting Service at Orlando Air Force Base, Florida. Its primary purpose is to keep Air Force personnel abreast of latest aerospace developments.

Willamette Iron and Steel Co., Portland, Oregon, has completed construction of the world's fifth largest stellar telescope. The $500,000 project took 2½ years to complete. The 70-ton instrument is complete except for reflectors, which are being finished by the Association of Universities for Research in Astronomy, Inc. (AURA).

Complete assembly of the telescope at Kitt Peak National Observatory awaits the final finishing of the reflectors, still about a year away. Kitt Peak is the national observatory now under construction in the Quinlan Mountain range 40 miles southwest of Tucson, Arizona.

The 84-inch telescope gives U. S. astronomers the world's fastest "F" ratio of 2.67 for faster exposure of photographs and consequently less interference from bad viewing conditions.

According to the company, production methods were used in building the complex instrument which called for tolerances as close as plus or minus .0002.

Plus or minus .0002 tolerance was required on the polar shaft concentricity and .0005 at a number of other points. Fabrication tolerance permitted was 3/16ths.

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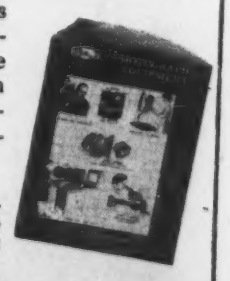

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Names in the News

Francis Colt de Wolf, former Chief of the Telecommunications Div., U.S. Dept. of State, has been named Special Advisor to the Office of Transport & Communications in the same Department. **Dr. Arthur L. Lebel** replaces Mr. de Wolf as Chief.

Paul B. Black has been appointed manager of headquarters marketing for Sylvania Electronic Systems.

William P. Murden, Jr., has been named Director of the Washington Research Office, Technical Operations, Inc.

George A. Gould has been appointed Senior Project Engineer, Republic Electronics Industries Corp.

Dr. John N. Goulias has joined the Washington, D. C., research staff of the Operations Evaluation Group, Massachusetts Institute of Technology.

Dr. Theodore H. Maiman has been elected vice president of Quantatron, Inc.

Stephen A. Keller has been named executive vice president of Telex, Inc.

Richard C. Koperek has been promoted to the newly-created position of vice president and treasurer of the Hallamore Div. of the Siegler Corp.

Brig. Gen. Charles F. Leonard, Jr., USA, former Director of Security, Mapping and Combat Intelligence, Office Assistant Chief of Staff for Intelligence, has been reassigned as Deputy Assistant Chief of Staff for Intelligence.

Paul Terranova was recently elected president of Merrimac Research & Development, Inc.

Fred Kann has been elected president of REDM Corp.

Maj. Gen. James Ferguson, USAF, former vice commander, Air Force Systems Command, has been named Deputy Chief of Staff, Research & Technology, Headquarters, U. S. Air Force, and promoted to three-star rank. **Maj. Gen. Clyde H. Mitchell**, USAF, has replaced General Ferguson as vice commander AFSC.

Robert E. Hysell has been appointed manager of materials engineering for the Rectifier Components Dept., General Electric Co., Auburn, N. Y.

Edward J. Whalen was recently elected vice president and deputy chief executive officer of International Telephone & Telegraph Communications Systems, Inc.

Clarence H. Lewis has been appointed manager of the Westinghouse Electric Corp.'s astroelectronics laboratory, Newbury Park, Cal.

Charles A. Mitchell has been named to the newly-created post of vice president in charge of marketing by Dictograph Products Inc.

James F. Healy has been appointed vice president of Minneapolis-Honeywell's Aeronautical Div.

James T. Pyle, formerly Deputy Administrator of the Federal Aviation Agency, has been appointed manager of General Precision's Washington, D. C. office.

Dr. Hiden T. Cox has joined the National Aeronautics and Space Administration as Assistant Administrator for Public Affairs.

E. W. Rawlings was recently named president of General Mills, Inc.

William T. Golden was elected Chairman of the Board of Trustees of System Development Corp.

Richard M. Mock has been elected to the Board of Directors of Astrodata, Inc.

Jack S. Parker has been appointed vice president and group executive in charge of the Electronic and Flight Systems Group, General Electric Co.

Roswell P. Barnes has recently been appointed head of Melpar's Applied Science Division Physics Laboratory at Watertown, Mass.

Brig. Gen. E. F. Jeffe, USA (Ret.), has been elected president and a director of General Bronze Corp.

COMMUNICATIONS—ELECTRONICS GLOSSARY

Acceleration — *The time rate of change of velocity. May indicate a change in speed, a change in direction, or a combination of the two.*

Access Time — *The time interval, characteristic of a memory or storage device, between the instant at which information is requested of the memory and the instant the information is available.*

Allowed Band — *A range of energies in which there exist electronic energy levels.*

Atmospheric Duct—*An atmospheric layer which conducts radio-frequency waves in the same manner as a true waveguide under certain conditions of temperature and humidity. The atmosphere forms one of the boundary surfaces of the duct and the earth's surface the other boundary.*

Barometer, Aneroid—*A thin disk of metal covering the aperture of a box from which the air has been exhausted. Variation in atmospheric pressure causes a bulging of the disk, which shifts a pointer over a scale and indicates the pressure.*

Baud—*The unit of telegraph signaling speed, derived from the duration of the shortest signaling pulse. A telegraphic speed of one baud is one pulse per second.*

Coaxial Cable—*A particular type of cable capable of passing a wide range of frequencies without the usual prohibitive losses.*

Computer, Analog — *A physical system with means of control for the performance of measurements (upon the system) which yields information concerning a class of mathematical problems.*

Computer, Digital — *A computer in which information, numerical or otherwise, is represented by means of combinations of characters in such a way that the number of distinguishable combinations is much greater than the number of distinguishable characters. A digital computer makes explicit use of a language.*

Jamming—*Transmission of a signal or signals to cause interference in the reception of another station or radar.*

Kerr Cell—*A cell with electrodes capable of holding a suitable dielectric fluid for observing the Kerr effect.*

Kerr Effect—*An isotropic substance when placed in an electric field behaving like a uniaxial crystal with the optic axis in the direction of the field.*

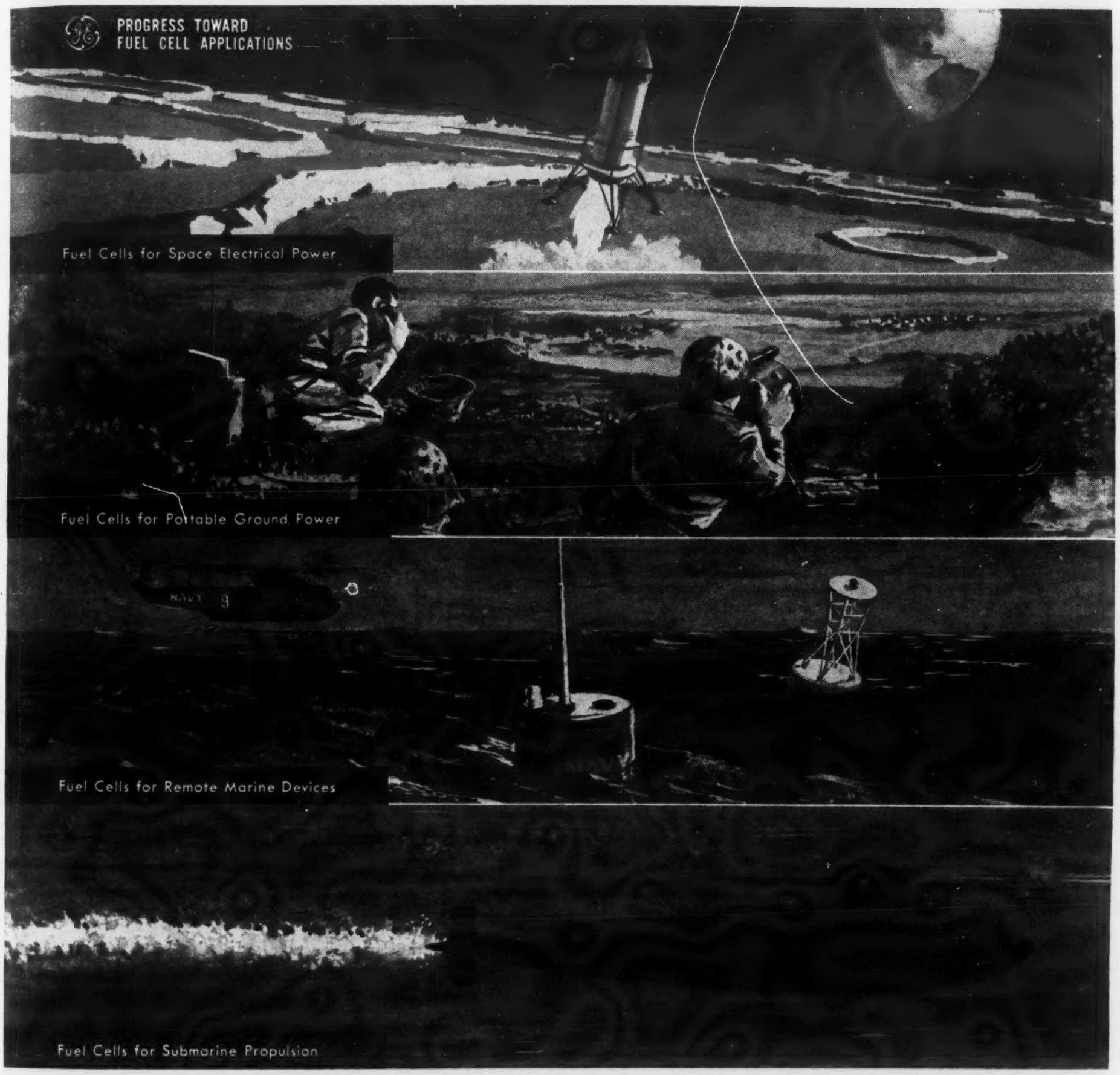
Magnetic Tape—*A magnetic recording medium having a width greater than approximately 10 times the thickness.*

MEW (Microwave Early Warning)—*A particular high-power, long-range, early-warning radar with a number of indicators, giving high resolution and large traffic handling capacity.*

Parameter — *A quantity which is a constant under a set of circumstances being considered at the moment, but which may have a different value under other circumstances.*

Telemeter—*The measurement of various quantities at a distance by the transmission of a signal by telegraph, telephone or radio.*

Yaw—*The movement of a missile or space craft about its vertical axis; the extent of this movement, measured in degrees.*


PROGRESS TOWARD
FUEL CELL APPLICATIONS
Fuel Cells for Space Electrical Power
Fuel Cells for Portable Ground Power
Fuel Cells for Remote Marine Devices
Fuel Cells for Submarine Propulsion

FUEL CELL PROGRESS at General Electric heralds an era when direct energy conversion can provide useful power for many strata of military applications, from outer space to ocean depths. General Electric has already passed notable milestones. Among them: Fall, 1960, the first space flight of a fuel cell power supply occurred in an Atlas nose cone; Summer, 1961, a portable 200-watt fuel cell battery became the first practical air-breathing unit when it demonstrated its capability to power field radar and radio equipment. And now, General Electric is working on fuel cell systems for orbiting space vehicles, lunar probes, submarine propulsion, and remote marine devices. For a report on the dynamic progress of fuel cell development at General Electric, write to Section 183-06, General Electric Company, 950 Western Avenue, Lynn, Massachusetts.

GENERAL ELECTRIC

New Fuel Cell Facility, Lynn, Mass.

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